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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

No. 2639, Vol. 105] THURSDAY, MAY 27, 1920 [Price One Shilling

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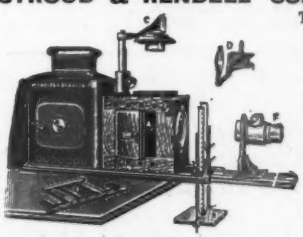

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2. A Course of Two Advanced Lectures on "EVOLUTION IN OSTRICHES," by Dr. J. E. DUERDEN, of South Africa, at King's College, Strand, W.C. 2, at 5 p.m., on Thursdays, June 3 and 10.

3. A Course of Two Advanced Lectures on "THE EVOLUTION OF INSECTS, ESPECIALLY AS ILLUSTRATED BY AUSTRALIAN FOSSILS," by Dr. R. J. TILLYARD, M.A., F.L.S., Director of the Cawthorn Institute, New Zealand, at the Imperial College of Science and Technology, South Kensington, at 5 p.m., on June 14 and 17.

Admission is free to all the lectures, which are addressed to Advanced Students of the University and others interested in the various subjects.

P. J. HARTOG, Academic Registrar.

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Parents (or guardians) of candidates must be resident within the administrative County of London, except in the case of self-supporting candidates over 21 years of age on July 31, 1920, who must themselves be resident within the County.

Forms of application (T.2/255A) may be obtained from the EDUCATION OFFICER, London County Council Education Offices, Victoria Embankment, W.C.2, and must be returned not later than June 5, 1920.

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Note.—The Egyptian Government bonus referred to consists of an increase of 20% to pensionable pay, and in addition a war gratuity of 60% on the salaries so improved, provided that the increase from the war gratuity does not exceed £192 per annum and that the total increase from both sources of increment does not exceed £300 per annum. The Pound Egyptian is worth about sixpence more than the Pound Sterling.

Applications, together with statements of qualifications and references, which will be received up to July 15, 1920, should be endorsed "Research Staff, Egyptian Ministry of Agriculture," and addressed to Sir ARTHUR WEBB, K.C.M.G., Queen Anne's Chambers, Broadway, Westminster, from whom all particulars regarding conditions of service, &c., can be obtained.

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NEW APPOINTMENTS.

The Board of Governors will proceed shortly to make the following appointments, for which applications are invited :—

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General information as to the University of Manitoba and its work may be obtained from Professor M. A. PARKER, c/o Messrs. Blackie & Sons, 17 Stanhope Street, Glasgow, or from Professor C. H. O'DONOGHUE, c/o Department of Zoology, King's College, London.

Five printed or typewritten copies of letter of application and testimonials should be in the hands of the SECRETARY of the Board of Governors on or before June 20, 1920.

In the case of the appointment in History one copy of the letter of application and of each testimonial should be sent to Professor CHESTER MARTIN, c/o Rev. C. P. Williams, Henfield, Sussex, and in the case of the appointment in Zoology one copy of the letter of application and of each testimonial to Professor O'DONOGHUE at the address indicated above.

The duties under the new appointments will begin on or about September 1, 1920. Address—

THE SECRETARY,
Board of Governors,
University of Manitoba,
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THURSDAY, MAY 27, 1920.

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The University of London: A Great Opportunity.

LAST week there was made public the details, printed elsewhere in this issue, of the offer by the Government of a site for the University of London. The Government proposes to give to the University about 11½ acres behind the British Museum as a site for the University headquarters and for colleges and institutions connected with it, including King's College, the premises of which in the Strand have long been insufficient for the needs of the college. The Senate has referred the question to a committee the report of which will doubtless shortly be forthcoming.

None of Mr. Fisher's labours in the cause of university education—and they are many—will redound more to his credit than the attempt to provide the University of London with a home worthy of itself and of the capital city of the Empire. Since the reconstitution of the University as a teaching body in 1900, a great deal has been done in the organisation of university teaching and research in London. The professors and teachers of the University include many most distinguished men of science and scholars, and in the number of students it easily takes the lead in Great Britain. In recent years the University has drawn students from all parts of the world, attracted by the unique advantages which London can offer by reason of the resources of its libraries and museums. The establishment in the heart of the City of the School of Oriental Studies, and the association of business men with the foundation of the scheme of degrees of commerce, show also that the University can, by recognising the needs of the commercial interests of the City, obtain their active assistance and support.

It cannot be gainsaid, however, that, in spite of all that has been done, the University has as yet failed to justify the hopes of those who looked forward at its reconstitution to the creation of a great teaching university. We need not enter into a discussion of all the causes which have prevented or hindered the fulfilment of these hopes. Among them are the heterogeneous nature of the institutions—varying from colleges of the type of University and King's Colleges to polytechnic institutions—in which the teaching and research work are carried on, and the intricacy of its existing constitution.

But unquestionably the chief cause of the failure of the University to take the great place assigned to it has been the discrete nature of its component parts, the inaccessibility of its administrative headquarters, and the lack of a home or a quarter of its own to which one could point as *the* University. It is a commonplace that bricks and mortar do not make a university, but it is undoubtedly true that without a tangible symbol there can be no appeal to the sympathies or imagination of the public, and it is the absence of such a symbol which more than anything else has militated against an understanding of the work that the University has done and is doing. Until the University possesses a building indisputably its own and designed for its own purpose, and until the great incorporated colleges are brought together, there can be no hope of impressing the greatness of the University upon the public, or of overcoming the dissipation of energy which is now such a hindrance to its work.

The question is, of course, not a new one. Its importance has been appreciated for some time, and before the war there were negotiations in the air for the acquirement of a site in Bloomsbury. For various reasons these negotiations did not fructify, and it may be that the site then under consideration was inadequate and in other ways unsuitable. The objections offered to it are not, however, valid in the present case.

The site now offered is excellent in every respect. By reason of its proximity to Bedford College for Women and to University College, it is already the nucleus of the "University Quarter" desiderated by the Haldane Commission. It is sufficient in extent not only for the administrative headquarters, the University library, and King's College, but also for other colleges of the University which are outgrowing their accommodation; and it is capable of extension if still further accommodation is required.

O

It is, what South Kensington is not, an easily accessible place, and yet is not too noisy for the purpose, and it will have the additional advantage of the near presence of our greatest library and museum. It is safe to say that there is at present no site in London comparable with it, and none so suitable is likely to be available for many years.

The only objection possessing any validity to the acceptance of the Government's offer is the financial one. This is, we admit, a serious question, and it would be foolish to minimise its importance. Hitherto both the University headquarters and King's College have been housed free by the Government. This arrangement will now come to an end, and it is obvious that the cost of covering the site with buildings that shall be worthy of London's University will be considerable. Mr. Fisher feels that in this the University can look with confidence to the generosity and public spirit which have always marked the citizens of London. We think he is right. We are convinced that, if proper efforts are made, enough and more than enough money will be forthcoming for the purpose. The results of the present Vice-Chancellor's appeal to the City in connection with the degrees of commerce of the University afford an index of the support that would be forthcoming from the City Companies and the great commercial houses if the sympathies and the co-operation of the commercial community were enlisted in the greater cause of the University as a whole. Private benefactors would be attracted to a bold and well-conceived plan of creating a great university quarter, and Londoners, if there were some outward and visible sign of the greatness of their University, would not be found wanting either in the civic pride or in the willingness to pay which is found in the provinces or in Continental cities.

We hope the University authorities will take their courage in both hands and go forward boldly. The reasons which forbid the Government from giving further assistance in these days may be regrettable, but they are easily intelligible. We are sure that if the University rises to the occasion neither this nor any future Government will be allowed to leave it to struggle unaided. We are equally sure that if counsels of timidity are allowed to prevail and this opportunity is lost the University will have forfeited irrevocably any claim on the public or the Government for support in the future.

Manuals on Applied Chemistry.

(1) *Practical Leather Chemistry: A Handbook of Laboratory Notes and Methods for the Use of Students and Works Chemists.* By Arthur Harvey. Pp. viii+207. (London: Crosby Lockwood and Son, 1920.) Price 15*s.* net.

(2) *Chemistry for Textile Students: A Manual Suitable for Technical Students in the Textile and Dyeing Industries.* By Barker North, assisted by Norman Bland. (Cambridge Technical Series.) Pp. viii+379. (Cambridge: At the University Press, 1920.) Price 30*s.* net.

(3) *The Chemistry of Coal.* By John Braithwaite Robertson. (Chemical Monographs.) Pp. viii+96. (London: Gurney and Jackson, 1919.) Price 3*s.* 6*d.* net.

(1) MR. HARVEY'S handbook is intended for the use of the works chemist in charge of the analytical and testing department of a tannery. It is an eminently practical work, well and clearly written with due regard to modern methods, and evidently based upon considerable personal experience. It presupposes that the user of the book has had not only a preliminary course of instruction in theoretical chemistry, but also the opportunity of a laboratory training in manipulation in qualitative and quantitative analysis. In these circumstances the book can be thoroughly recommended as an excellent *vade mecum* to the work of the chemical laboratory of a tannery, or to the student who intends ultimately to specialise on leather chemistry. It will be found to cover practically every problem that the works chemist of a tannery may have to face. The analytical methods described have been thoroughly tested, and are well adapted to practical conditions.

(2) The manual by Mr. Barker North and Mr. Norman Bland is a work of a very different class. It is essentially a text-book of the elementary chemistry of certain of the non-metallic elements and their compounds, together with a somewhat bald account of the chemistry of a few carbon derivatives. The section devoted to technical chemistry as applied to the textile industries occupies only some twenty-eight of the 379 pages of which the book consists. The authors are lecturers in chemistry to the evening classes of the Technical Colleges of Bradford and Huddersfield respectively, both important centres of the textile and dyeing industries, and their object, no doubt, is to attract students who are, or may be, engaged in these industries. In their preface they point out that whilst the cotton and woollen industries occupy most important positions

among the nine leading industries of the country, it is only within recent years that even enlightened employers have begun to realise that "chemistry and physics play a most important part in the various operations used in the production of yarns and finished pieces."

All this may be very true. But it is equally true that the hard-headed Yorkshire manufacturer who turns over the pages of this well-printed and handsomely illustrated book will be slow to perceive wherein it bears directly upon his industry. He will be apt to think that the kinetic theory and Avogadro's hypothesis have as little to do with woollens and worsteds as the binomial theorem has with the common pump. There is not the slightest intention to minimise the importance of a knowledge of the principles upon which chemistry as a science is based, or to depreciate its value when applied to industry. It is admitted, of course, that no technologist is adequately trained who is wholly ignorant of the science. But in compiling a text-book which would seem to be mainly directed to the work of their classes the authors have attempted too much. They have mixed up purely elementary doctrinal chemistry with applications involving a very different kind of knowledge. The problems of textile chemistry are far more recondite than their association with rudimentary chemistry, as in this book, would seem to imply. We have no fault to find with the book as a text-book to accompany an experimental course of evening lectures such as the authors are engaged in giving, except that its price will probably be beyond the means of the ordinary evening-class student.

The course as set out in the book is well arranged, and it is intended that the pupils shall themselves perform many of the elementary experiments described, presumably in a laboratory class. There is no doubt that if they work through the list under competent direction they will acquire a considerable amount of information, and gain some proficiency in chemical manipulation. No special experiments are described in the section devoted to the systematic study of the non-metals and their important compounds, or in that concerned with the chemistry of the hydro-carbons and their derivatives, but the student is directed to "pick out the portions which are suitable for experimental illustration with the apparatus at his command"—a direction which, it may be hoped, will strengthen any latent power of original investigation that he may possess.

The scope of the teaching has presumably been limited to what has been found to be practicable in such courses of evening-class instruction as are possible in the institutions with which the authors are connected, and there can be no doubt that if the beginner faithfully follows the teaching and supplements it by reading the "larger and more specialised works" to which he is referred, and which, it is to be hoped, he will find in the libraries of the schools to which he may be attached, he will have acquired a very fair acquaintance with the elements of chemistry. But as he pursues his reading, and enters upon the perusal of the more specialised works on the chemistry of textiles, he will realise that he has got no further than the alphabet of the subject. After all, a knowledge of the alphabet is an essential step, and it may be that the authors, *pace* the title of their book, have aimed no higher. The time will come when our technical schools will not mix up elementary with applied teaching, but make each section independent. Applied chemistry must of course be based on elementary and theoretical chemistry, but there are no short cuts to proficiency in any one branch, and it is a bad system of instruction which fosters the idea that there can be.

(3) In about ninety small octavo pages Mr. J. B. Robertson, lecturer in chemistry at the South African School of Mines and Technology, Johannesburg, has sought to give an account of the chemistry of coal. His title may be held to imply more than his little monograph actually covers, as he confines himself to a very limited portion of what in reality is a very wide field, and has very little to say respecting the chemical derivatives of coal, except to the extent that they may be supposed to throw light on the nature of the proximate constituents of coal. In five short chapters, or sections, Mr. Robertson discusses the mode of occurrence of coal, its origin, and the various methods of classifying it; the action of solvents, *e.g.* benzene and pyridine, etc., upon the coal substance; its oxidation and destructive distillation. The summaries are exceedingly short, but they are accurate and fairly up-to-date, and at least serve to show how much remains to be done before the real chemical nature of coal is elucidated. Practically all that we know at present is that coal consists of a variable and indefinite mixture of at least two constituents, one of which appears to be a degradation product of cellulose, and the other a resinoid substance which can be extracted by appropriate solvents; and that it is upon the relative proportion of these constituents that the technical value and industrial applications of coal largely depend. But the precise nature of these constituents is as yet very imperfectly defined, and the suggestions that have been made as to their origin are little more than surmises.

The most detailed sections of the book relate

to the analysis of coal, proximate and ultimate; these, compared with the preceding sections, are remarkably full and evidently based upon personal experience. It would have added to the comprehensiveness of the account if a description of the methods of determining arsenic had been given. Owing to legislation arising out of the arsenic-in-beer scare the value of coal, especially anthracite, for kilning purposes is greatly affected by the presence of even small quantities of arsenic. The method of determining the calorific value of coal would have been rendered more intelligible if the description had been accompanied by an illustration of the calorimeter. Lastly, we deprecate the practice of placing the bibliographical references in the text at the end of the book. This method, at least as regards chemical literature, seems to have originated in Germany. We fail to perceive that it has a single redeeming feature. On the contrary, it produces the maximum amount of inconvenience. It involves constant turning backwards and forwards, which is apt to become tiresome and to lead to error. It is far preferable to embody the references in the text, or at least to place them as foot-notes to the pages on which they occur.

A Standard Book on Soils.

The Soil: An Introduction to the Scientific Study of the Growth of Crops. By Sir A. D. Hall. Third edition, revised and enlarged. Pp. xv + 352. (London: John Murray, 1920.) Price 7*s.* 6*d.* net.

IT is pleasant to see that Sir Daniel Hall's book on the soil has now reached a third edition. It will have a permanent place in British agricultural literature as the first book on the subject in the modern period. Its distinguishing feature, which marked it off from its predecessors, is its clear recognition of the complexity of the soil problem, emphasised in the opening words and maintained throughout: "In the scientific study of soils, chemical, physical, and biological considerations are involved." Successive generations of earlier workers had regarded soil fertility as essentially chemical, physical, or bacteriological. This book was the first to show British readers that all these different views had a basis of truth, but that each by itself was too narrow. The study of the soil, in short, cuts across the conventional divisions of science and brings together such apparently diverse workers as the physicist and the protozoologist, the mathematician and the plant physiologist, and others who in an ordinary scientific laboratory would be supposed to have nothing in common.

To write an adequate review of the book, comparing it with the preceding editions, would be to write a history of the development of modern soil science, and could not be done in a short notice. The leading advances have been in our knowledge of the constitution of the soil and of the population inhabiting it. In both directions recent investigations have revealed greater complexity and emphasised still further the need for "team" work to supplement the indispensable, but limited, individual work.

Ten years ago there was only one soil biologist at Rothamsted; now there are nine, and others, it is hoped, will soon be added. Bacteria were at first supposed to be the only organisms concerned; now it is realised that fungi, actinomycetes, algæ, and protozoa are all present in the soil, and probably all concerned in some way in the great changes going on.

Sir Daniel stimulates a living interest in the subject and makes constant reference to the experience of farmers, gardeners, and others in soil management and in the behaviour of plants in different soil conditions. These serve to show the student how much remains to be done in spite of all the advances of recent years; in this way also the book acts as a valuable corrective to the tendency showing itself in certain modern text-books of regarding the soil as a physico-chemical system the properties of which are expressible in mathematical terms. These analytical methods have their uses, but they would become dangerous if they were allowed to obscure the complexity of the problem.

There is a valuable section on soil types containing much information of interest to the ecologist as well as to the agriculturist. The section on land reclamation is of particular interest at the present time and has a breadth of view and a freedom from extravagent anticipations rarely found in discussing this important subject. Altogether the book keeps up its reputation and will prove invaluable to the serious student of the subject.

E. J. R.

Savages of the Far Past.

An Introduction to Anthropology: A General Survey of the Early History of the Human Race. By the Rev. E. O. James. Pp. ix + 259. (London: Macmillan and Co., Ltd., 1919.) Price 7*s.* 6*d.* net.

MR. JAMES aims at introducing the student not so much to anthropology in general as to prehistoric archæology interpreted in the light of the study of primitive man, modern as well as ancient. After an introductory chapter outlining

the scope of anthropology conceived as the study of man in evolution, he proceeds to sketch the evidence relating to the side of somatology. Considering the limitations of space, his account seems fairly complete. A few slips occur. *Trogontherium* will scarcely do as the name of a kind of elephant. *Rhinoceri* reminds us of *octopi*. More important, it is a pity to adopt Klaatsch's term "Aurignacian man" to describe a physical type (Combe Capelle), seeing that to do so is to correlate a race with a cultural type which may or may not have been confined to that race—nay, probably was not. Next, the characteristic forms of industry are described. We note that Mr. James is inclined to accept the Sub-Crag flints as of genuine human workmanship. He also takes the view that the Mousterian industry is inferior to the Acheulean, representing a set-back in culture and not an advance as effected by a labour-saving device. Mr. James is entitled to judge at first hand, inasmuch as he has worked on a Mousterian site (Jersey), where material was plentiful. Perhaps he does not sufficiently allow for the fact that, if finely wrought pieces were but as one in every hundred fragments forming the workshop refuse, these masterpieces were of a very high quality, symmetrical in outline and smoothly and delicately finished off.

The book then goes on to try to construct some picture of the social organisation and magico-religious beliefs prevailing during the prehistoric period, and especially among the later cave-men. Necessarily the treatment is somewhat speculative, but the analogies provided by modern savages are put forward without dogmatism and so as to invite the student of archæology to equip himself for his special task by acquiring the elements of anthropology as a whole. Mr. James has already written on the subject of primitive religion, with special reference to the Australian aborigines. The latter, then, naturally provide him with most of his clues, but here he has the support of most writers on this branch of the subject, from M. Salomon Reinach onwards. Certainly it is hard to resist the impression that the drawings found in the deep recesses of caverns, as at Niaux, served a magico-religious purpose; art for art's sake would surely have craved a good light. What, then, more natural than to compare the Australian *intichiuma* ceremony with its rock-drawings demonstrably designed to further the multiplication of animals and plants fit for human consumption? It does not follow, of course, that every institution of the Australians can therefore be fathered on the men of Pleistocene Europe. Totemism is more doubtful than *intichiuma*; delineations of embryonic spirits (*inapertwa*) are more doubtful than either; while *churingas* and Azilian coloured pebbles are not to be identified offhand. Mr. James, however, steers his way warily among these tempting possibilities, and the result is a manual which will make the student think without professing to supply the thought ready-made. R. R. M.

The Problem of Clean and Safe Milk.

The Modern Milk Problem in Sanitation, Economics, and Agriculture. By J. Scott MacNutt. Pp. xi+258+16 plates. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1917.) Price 10*s.* 6*d.* net.

THE purpose of the author of this volume is to provide a convenient survey of the practical, economic, and sanitary factors of the milk problem, so as to meet the needs not only of health officers and milk inspectors, but also of dairymen, city milk dealers, agricultural authorities, consumers, physicians, and all others who are interested in the problem.

This survey is almost entirely based upon the experience gained in the United States as set forth in official reports or publications which have appeared in America, mostly since 1910.

The author knows that the milk question has also received the attention of some European workers, and refers in a few words (p. 66) to the communication made by Mr. Ernest Hart at the International Medical Congress held in 1881, in which mention is made of sixty-nine epidemics of disease attributable to milk. The only other English writer specifically mentioned in the text is Smollett (p. 32); the very realistic description of the milk consumed in London introduced by that author in a letter of Mr. Bramble to Dr. Lewis ("The Expedition of Humphrey Clinker") is certainly very interesting, for it shows that the milk problem already exercised the minds of thinking men some 150 years ago.

Although European observers have little to learn from their American colleagues regarding the causes of the deplorable state of the milk consumed in large and other towns, and its serious consequences, it must be acknowledged that greater enterprise has been shown in the United States in the devising of methods and regulations having for their object the improvement of the milk supplies.

It is specially on that account that the book will prove useful to British readers, who will find in it a comprehensive and critical summary of many of the results obtained in America by sanitary and agricultural authorities, as well as by various

committees, associations, and individual observers. The author shows not only that much progress has been made towards the solution of the problem, but also that some of the methods which have been tried, such as the score-card method of inspection, are by no means so useful as some enthusiasts on this side of the Atlantic have proclaimed.

The author is justly impressed by the merits of the North system (p. 78), the object of which is to prevent contamination of the milk at the time of milking by simple but essential precautions which can be taught to any farmer, the part of the work which cannot safely and economically be carried out at an ordinary farm being undertaken at well-equipped stations.

The quality of the milk is determined by the amount of butter-fat and the number of bacteria. A premium is paid for milk containing less than 10,000 bacteria per c.c., and also when the butter-fat exceeds a certain standard—say, 3·7 per cent.

Notwithstanding many repetitions, the book is interesting from beginning to end, and is written in a clear and popular style, which to an English reader derives a certain quaintness from its Americanisms. SHERIDAN DELÉPINE.

Our Bookshelf.

The Whole Truth about Alcohol. By George Elliot Flint. With an introduction by Dr. Abraham Jacobi. Pp. xii+294. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1919.) Price 6*s.* net.

THE writer of this book is an uncompromising anti-prohibitionist, and a whole-hearted supporter of St. Paul's dictum with regard to the use of alcohol. He considers that alcohol has been greatly maligned, that many of the vicious attacks upon its use have no basis of real evidence, of reason, or of common sense, and that its influence for evil and as a deteriorator of the human race has been, at least, greatly exaggerated. He discusses *seriatim* the many statements that have been advanced regarding the deleterious action of alcohol, even in the most moderate doses, and the better state of total abstinence, and he adduces many arguments and some facts contravening these.

On the whole, the tenor of the book is reasonable, and the conclusion is that moderation never hurt anyone, and in some respects is better than total abstinence. With many of the author's views we are in sympathy, and we fully agree that prohibition is not the best route to temperance. Like him, we doubt if the moderate use of alcohol is in any sense deleterious; but the difficulty is to define what is moderation, and we are sure that many who take alcohol in what they regard as strict moderation are exceeding the harmless dose. For anyone who desires the anti-prohibition view the book will furnish a wealth of matter, but it is written largely from the American point of view.

Dr. Jacobi contributes a brief but interesting introduction, in which he states that in the worst cases of sepsis and toxæmia—*e.g.* in diphtheria and puerperal fever—alcohol in the largest doses furnishes the only salvation. With this view we largely agree; but the use of alcohol in disease is of course on a very different footing from the general use of alcoholic beverages in health.

R. T. H.

The Geography of Plants. By Dr. M. E. Hardy. Pp. xii+327. (Oxford: At the Clarendon Press, 1920.) Price 7*s.* 6*d.* net.

THE present volume is a continuation of the introduction to plant geography by the same author issued in 1913 as one of the series of the Oxford geographies designed by the late Prof. and Mrs. Herbertson. It may be regarded as an expansion of part iii. of the earlier work; the slight survey of the continents given there has served as the plan for the new book, which embodies a discussion of the conditions in which plants flourish, and their distribution in the great geographical divisions of the earth. The great continents are considered in successive chapters—Asia, North America, South America, Australia, Africa, and Europe—and each chapter gives a concise account of the physical features and climate, the bearing of these upon the extent and character of the vegetation, and their relation to the support and development of mankind. The book is profusely illustrated with maps and a well-selected number of photographic reproductions of aspects of vegetation. There is a geographical index, and also one of plant names, in which the scientific and popular names of the plants referred to are arranged under the different continents. The little volume should interest alike students of geography and botany, and botanists especially will welcome it as filling a gap in their series of text-books.

A Handbook to the Vertebrate Fauna of North Wales. By H. E. Forrest. Pp. v+106. (London: Witherby and Co., 1919) Price 6*s.* net.

MR. FORREST, the author of "The Vertebrate Fauna of North Wales" (1907), has now published this shorter "handbook," convenient for naturalists and interested visitors. It deals with 28 prehistoric mammals, 8 mammals extinct during the historic period, 43 existing mammals, 227 birds, 5 reptiles, 6 amphibians, and 151 fishes. Under each species is a brief summary showing its status and distribution in the area. Trustworthy information has been collected from many observers, and the whole work is marked by careful precision, an indispensable quality in faunistic census-taking.

Letters to the Editor.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.]*

Scientific Work: Its Spirit and Reward.

THE true incentive of the scientific worker is his work. Through his work he expresses the creative thought within him, which he feels to be his highest life. This expression must through its very nature be free, otherwise he becomes a slave in the worst sense, in that the free exercise of intelligence is denied him.

Because this freedom is sacred to the scientific worker he sometimes has to sacrifice income and the possibility of family life to retain it, but this is a mere misfortune, not in any sense a necessary concomitant of scientific ability. The sentimentalist and the exploiter have promulgated the idea that the scientific worker, being exalted above the need for normal human joys and amenities, works best on the smallest possible income; or, having found that this does not always work out in practice because it tends to reduce the output of useful results, as the reduction of rations to one bean per day led to the unfortunate demise of the horse, the opposite line is taken, and it is supposed that by large remuneration the valuable work looked for can be bought.

Neither the one nor the other point of view is correct. The scientific worker if he is normal needs the means to enable him to have a happy, care-free home-life, and to educate his children in such a way that they in turn may be free as he would be. Therefore to starve him is to eliminate the normal and consequently intelligent worker in favour of the eccentric. For let it be clearly stated, the highest intelligence is always supremely sane. The idea of a scientific worker as a harmless lunatic is by no means confined to sensational fiction, although it might as well be imagined that every long-haired user of a piano is a Paderewski, or every loose-tied splasher of paint on canvas a Sargent.

On the other hand, to believe that creative thought can be purchased with money is to repeat the mistake of Simon Magus. Imitative thought in all its manifestations can be obtained for an adequate remuneration, because it can be produced by outward drill, discipline, and experience. So experts in the orderly routine dear to the official mind can be turned out by mass-production like cheap crockery, and are similarly useful and indispensable.

There is, however, no means of estimating the value of one really original thought either in pure or in so-called applied science. Certainly the possession of anything like its value in money would often be an embarrassment to the scientific worker through whom it is expressed. He also would be the first to disclaim any absolute or exclusive right to it. In the last analysis, humanly speaking, there is no such thing as an absolutely original idea, and it is seldom that any single individual can claim undivided credit for bringing a new idea to birth.

On the other hand, to divide its money-value, if it have any, in such a way that little or nothing comes back to the immediate originator is simply unjust, and therefore ultimately disastrous.

A certain type of person sniffs at Lord Kelvin for having become part owner of numerous important patents. No one will deny Lord Kelvin's position as a scientific worker; that he was also a business man merely means that his gifts were more readily applied to the good of humanity.

That a scientific worker should be debarred from any reward or protection by patents embodying his discoveries, because of his occupying either a public or private salaried position, is not only unjust, but also often unbusinesslike and against the public interest. The equitable adjustment of rights and returns as between public or private capital and the actual inventor is often the only way to prevent exploitation by purely selfish private interests.

To repeat, the true incentive of the scientific worker is his work. Salary, kudos, position, *esprit de corps*—these are incentives to good and useful people, but they are not the true incentives of the real scientific worker. To obtain the best from him, he must before all things have freedom, and, if possible, also a reasonable measure of justice.

"The bearings of this observation," as Capt. Bunsby in "Dombey and Son" remarked, "lays in the application on it."

GILBERT J. FOWLER.

Indian Institute of Science, Bangalore, India.

Applied Science and Industrial Research.

AT a meeting held at the Birkbeck College on April 28, organised by the National Union of Scientific Workers to urge more public support of scientific research, Prof. Soddy, the principal speaker after Mr. H. G. Wells, who occupied the chair, made a strong attack on the Department of Scientific and Industrial Research and the industrial research associations which have been, and are being, established under its ægis (see NATURE for May 6, p. 309). As much of Prof. Soddy's criticism seems to lend colour to current misconceptions of industrial research and of the functions of the research associations fathered by the Department of Scientific and Industrial Research, I beg the hospitality of your space for the following observations.

No one disputes the vital and urgent need for increasing the facilities for scientific study and scientific research. All those who know the facts will echo Mr. H. G. Wells's just indignation at the national neglect of science and the half contemptuous treatment by the State of our great men of science. I go further and agree with Prof. Soddy that in the extension and intensification of scientific study and research the claims of pure science must be primary and paramount. But I deny emphatically that this involves a similarly short-sighted and contemptuous attitude towards the needs of applied science and industrial research. If English industry has suffered too long from the dominance of mere rule-of-thumb methods; if our manufacturers have, through ignorance, underrated the value of science, the fault has not been wholly and exclusively theirs. The academic people who have contemned applied science and industrial technology as something little better than a crude empiricism must bear some share of the blame. The manufacturer may have kept his feet too much in the mud; the academician has too often kept his head entirely in the clouds. If one has been too disdainful of scientific methods that did not ensure or promise immediate dividends in cash, the other has talked at times as though the mere prospect of a utilitarian issue to a specific research were enough to defile it and make it unworthy of his serious attention. We all know the type of academic science worker to whom an investigation of the internal structure of the atom is a noble and purifying pursuit, and

a research on soap an ignoble and degrading occupation; as though atoms *per se* were inherently dignified and only became disreputable when associated with other atoms to form the molecules of a useful, if homely, commodity. There are many forms of snobbery. Pure science itself has had to put up with a good deal of classical snobbery, as Mr. Wells has more than once testified. I doubt whether matters will be mended by a development of such a form of scientific snobbery as seems often to be the inspiration of the disparagement, in academic circles, of applied science and industrial research.

Fortunately this attempt to erect an arbitrary and artificial barrier between pure and applied science is becoming progressively discredited as the nature of industrial research and its dependence on pure science are becoming better known. Every research in applied science, if it is to be thorough, involves some research in pure science. An industrial problem may be, and often is, the starting-point of a research that may widen the bounds of knowledge as much as any research born of a conception in pure science. Applied science and industrial research have been developed more widely in America than in any other country, if we except Germany. How does American experience confirm the view that to foster industrial research is to starve pure research? In the paper on "Industrial Research in the United States of America" by Mr. A. P. M. Fleming, published for the Department of Scientific and Industrial Research, there is abundant testimony to the recognition, by firms and institutions engaged in industrial research, of the importance of pure science research. Such an industrial leader as Dr. J. J. Carty, vice-president of the American Telephone and Telegraph Co., in his presidential address to the Institute of Electrical Engineers in 1916, emphasised this view: "By every means in our power, therefore, let us show our appreciation of pure science, and let us forward the work of the pure scientists, for they are the advance guard of civilisation. They point the way which we must follow." Mr. Elihu Root, chairman of the board of trustees of the Carnegie Institution of Washington, in a paper on the need for organisation in scientific research, makes the same point: "While the solution of specific industrial problems and the attainment of specific industrial objects will be of immense value, the whole system will dry up and fail unless research in pure science be *included within its scope*." Mr. W. A. Harmor, assistant director of the Mellon Institute of Industrial Research, University of Pittsburgh, bears similar testimony to the needs of pure science: "The wide view is now taken that, in considering the needs of industry, pure science investigation has as essential a contributory function as that specifically devoted to the attainment of some technologic objective." One could multiply almost indefinitely such tributes to the primary and paramount necessity of investigations in pure science from men and organisations concerned mainly with industrial research. Prof. Soddy's argument that for the million of money which the Government has expended or earmarked for scientific research pure science has got little or nothing is, therefore, based on a misconception of the nature of industrial research, and is directly contradicted by past experience and present knowledge.

The assumed antagonism between pure and applied science is baseless in fact and mischievous in tendency. As Mr. Harmor has well said: "Both pure and applied research are of the same order of importance and each has its own related field." The alleged inferior character of applied research as compared with pure research has no better foundation in fact than the alleged inferiority of scientific studies, as instruments of intellectual training, to classical studies. As Mr. A. W. Mellon, president of the Mellon National Bank of Pittsburgh, in an article on the value of industrial research, aptly expressed the matter: "The fundamental differences between pure research and industrial research are, indeed, traceable to the differences in the poise and personality of the representatives of each type of scientific investigation. Success in genuine industrial research presupposes all the qualities which are applicable to success in pure science, and, in addition, other qualities, executive and personal, more or less unessential in the pure research laboratory."

It would be strange if it were not in line with other experience that every time an attempt is made to extend and foster applied science and industrial research someone raises the cry that pure science is thereby being neglected and starved. This is to argue as though the total fund, both of money and energy, available for the purposes of scientific education and research were a fixed fund, so limited that any amount devoted mainly to the purposes of applied science must thereby lessen the sum available for pure science. It is a fallacy on a par with the trade-union notion that increased production by the individual worker will increase unemployment, and, by augmenting the profits of the employers, diminish the wages of the employees; and it is a proof, if proof were needed, that academic trade unionism can be as selfish and short-sighted as any other kind. Yet, just as the present condition of Europe affords a plain proof of the economic truth that the weakness of one nation impairs the strength of all, so will the cause of pure science not be bettered, but rather worsened, by attempts to crab the progress of industrial research.

The Department of Scientific and Industrial Research, as Sir Frank Heath has well said, is engaged on a great adventure. Thanks largely to its efforts, already the spirit of science is stirring among the dry bones of industries to which it was previously little known. The research associations formed and to be formed, which will cover a wide and diversified area of British industry, are attracting, and are destined to attract, scientific workers of the highest distinction and widest outlook, among them, no doubt, many of the members of the National Union of Scientific Workers, under whose auspices Prof. Soddy made his attack on the Department and the research associations. I submit that the cause of pure science is not well served by inconsiderate attacks on this industrial research movement, which is admittedly a novel experiment, beset by unforeseen, because unprecedented, difficulties, but the success of which must react to benefit pure science as well as to redeem British industry.

J. W. WILLIAMSON.

26 Russell Square, W.C.1, May 6.

A Rainbow Inside Out.

IN February last Mr. P. H. Hepburn directed my attention to some surprising light-bows he had observed on several occasions on the surface of one of the ponds on Hampstead Heath. On February 24 we examined them together. A footpath lighted by three electric street-lamps runs along the southern edge of the pond. As one passed along this path bright bows of strange forms cast by the lamps were seen to spring out from the edge. The night was dark, the air still and slightly foggy, and the water smooth and covered with a film of scum extending as far as we could see in the dim light. There was no frost. The bows were judged to be on the surface

of the water, which was only about a foot below the level of our feet.

The form of the bows is shown in Fig. 1, which is taken from a rough sketch made by the writer from memory after returning home and before any explanation of the phenomenon had suggested itself. Here O is the observer in three positions, I., II., and III., and the bows seen from these positions are numbered correspondingly. The twin bows seen in position I. and the double curvatures at α in positions II. and III. struck us as remarkable. As the observer moved from the first position to the second, the nearer branch of I. sank into the bank of the pond and the

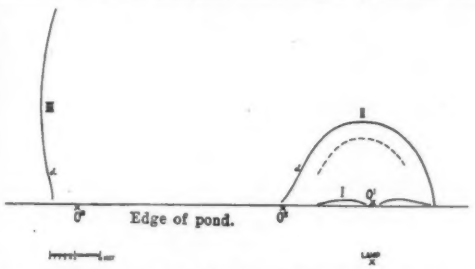


FIG. 1.—O^{I}, O^{II}, O^{III}, three positions of the observer's eye; I., II., III., the bows seen in these positions; α, points of double curvature.

further branch sprang out in a somewhat startling manner until it attained the size roughly shown at II. The observer proceeding towards III., the apex of the bow, became lost in the distance.

The bows were colourless except for a tinge of red on the inside and of light of shorter wave-length on the outside. They formed the limiting inner edge of faint, diffuse luminosity extending over the general surface of the pond, and within the bows was darkness. In position II. a ghost of an inner bow was seen within the principal bow, roughly as shown in the figure. No colour could be distinguished in this inner bow.

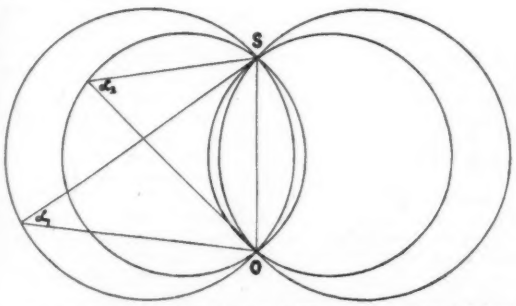


FIG. 2.—S, source of light; O, eye of observer; α_1, α_2, angles of minimum deviation for primary and secondary bows respectively.

In the first position the surface of the water was only about 5 ft. below the eye, and around the shadow of the observer's head—on the fog as we thought at the time, but on the water-surface as we now believe—the diffuse light was brighter, forming an aureole a few inches in breadth. When the head was turned slightly, so that a ray of light from the lamp to the water could pass close to the eye, the aureole at the edge of the shadow near this eye became brighter, suggesting that a ray reflected directly back on itself was of considerable intensity.

On subsequent nights we returned to the spot in the hope of again seeing the phenomenon, but, doubtless owing to a change in the weather conditions, we saw nothing. We took measurements, however, and from these data Figs. 3 and 4 were calculated.

The explanation of the phenomenon appears to be as follows:—In certain weather conditions globules of water are deposited from the fog upon the scum on the surface of the water, and the bows are formed in a way similar to those cast by the sun upon a bedewed field—with this difference: that here the source of light is near the observer. The bows, indeed, are rainbows.

In order that a drop of water shall be so placed as

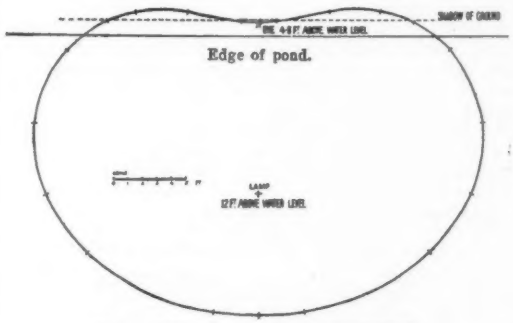


FIG. 3.—Primary bow, position I., as calculated.

to return to the eye a maximum amount of light in the manner that obtains in the rainbow, it is necessary that the line joining the source to the eye shall subtend an angle α at the drop, where α is the angle of minimum deviation. The locus of such suitable positions for the drop is the surface of revolution of a circle, of which the line joining the source to the eye is a chord, about this chord (see Fig. 2). The locus, then, is a toroidal figure like a flattened apple. The locus for the secondary bow is such a toroidal

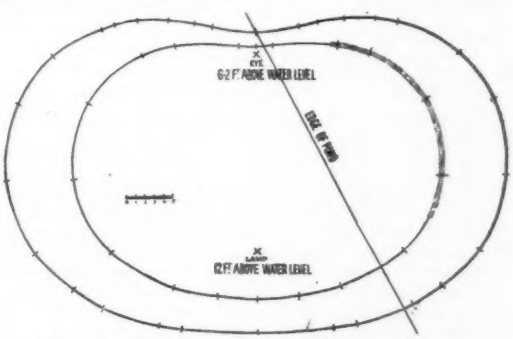


FIG. 4.—Primary and secondary bows, position II., as calculated.

figure within that for the primary bow. When the source of light is at infinity, as in the case of the sun, these figures become resolved into two co-axial conical surfaces having the eye at their common apex. In the present case the drops were confined to the plane surface of the water, and the bows seen were plane sections of these figures.

In order to test the soundness of this explanation, the writer has calculated the form of the bows from the equation of the section of the toroidal figure made by the water-surface, using as data the measurements taken of the positions I., II., and III., and giving α the values 42° and 53° for the primary and secondary

bows respectively. The results for I. and II. are shown in Figs. 3 and 4. It is unquestionable that these curves faithfully represent the phenomenon as we observed it, the portions shown with thicker lines being those within the limits of the water, which alone we were able to see. The calculated curve for III. (not shown) is equally corroborative. The aureole seen round the shadow of the observer's head is consistent with the attribution of the phenomenon to water globules upon a surface (see J. M. Pernter, "Meteorologische Optik," 1910, p. 424).

It is of interest to note that the closed curve is a rainbow inside out, and with the secondary bow within the primary.

Since writing the above we once again found the bows visible, and a careful examination of them seemed to confirm the conclusions arrived at on every point. On this occasion the film was broken by spaces of clear water, and at these spaces the bows were interrupted. The space within the inner bow was filled with faint, diffuse luminosity, and a marked feature was the blackness of the zone between the inner and outer bows. C. O. BARTRUM.

32 Willoughby Road, Hampstead.

"All-or-None" in the Auditory Nerve.

PROF. D. C. MILLER ("The Science of Musical Sounds," 1916, p. 184) admits the reality of beat-tones, but says that they are purely subjective, having no physical existence. This seems unsatisfactory. To begin with *beats*, it is wrong to say that it is the places of maximum intensity which are properly called *beats*. This is an illusion, due to too familiar diagrams. The maximum of intensity occurs at no place, but at a point of time which, at its own instant, the maximum not being absolute, is not impressive. At any point of time the next vibration of a sound may be of greater amplitude or it may not, and the listening ear, being unable to foretell, cannot tell us in the present when the maximum is attained. The perception of a maximum is bound to arrive, in fact, the day after the fair, when the sound is on the wane. On the contrary, it is the minimum of intensity which gives the effect of the beat. This is clear if the two primary tones are of equal amplitude and there is a phase of silence, when the difference of sensation is a difference, not of *degree*, but of *kind*. It has been shown that if a musical note is suddenly reduced to silence, the interruption of the series of vibrations restores the last of the series of periodic impulses to its isolated value; the note ends with a kind of shock or tap, comparable to one of a series of hard beats. If periodic beats are rapid enough, the final impulses at the interruptions form a fresh series, and are free to evoke in the sensorium a sensation of tone of the same frequency as the beats, a beat-tone; and this is best observed when the beats are not too violent.

Beat-tones are, therefore, no more subjective and have no less physical existence—although they may have been invisible hitherto in tracings and photographs—than any other real tone; and since both beat-tones, p-q and $2q$-p, are best heard, at least with intervals less than an octave, when the primaries are not powerful, there never has been a good reason for rejecting Young's view of their origin, nor for ascribing to Kœnig the discovery of those "upper" beat-tones which were discussed by Young before the Royal Society in 1800. (In Faraday's copy of the 1807 quarto there is a book-mark at p. 544 of vol. ii., perhaps indicating that the chapter on the coalescence of musical sounds has more than an historical interest.)

But beats are produced by primaries of unequal amplitude, and in such cases there is no phase of silence, and apparently no absolute minimum of intensity. Here we have something comparable to the first *d* in "would do" rather than the first *t* in "not too," to a *voiced* rather than a *voiceless* occlusive. If in the physiology of hearing we assume similarity of character in the nervous impulse to that which is established for motor nerves, the contribution of a single nerve-fibre, not being greater than the faintest sound audible in a sound-proof room, is in ordinary circumstances imperceptible; in the fluctuating intensity of a beating note many fibres will be implicated at the maximum; at the minimum, relatively few. At a minimum of intensity which is not absolute some fibres will continue to conduct the series of impulses of the note, while others will at this instant discontinue, and the impulse preceding the interruption may evoke the displeasing sensation of a noise, whereas with slow beats, where the discontinuity in many fibres is spread over a longer time, the effect is not so, but pleasant. Hence with two primaries of nearly the same frequency we may hear at the same time beats and the beating note. When the interval between the primaries is sufficient for the frequency of the beats to be that of a real tone, we may in the same manner hear at the same time the separate primaries and either the beats or the beat-tone, or both the beats and the beat-tone. Further application of this principle will be found to offer a solution of other obscure problems in hearing.

W. PERRETT.

University College, Gower Street, May 20.

British and Foreign Scientific Apparatus.

MY attention has been directed to a letter appearing in the issue of NATURE for May 6 dealing with the subject of scientific apparatus. Your correspondents are extremely moderate in tone, but they do not state the class of apparatus to which they are referring.

Members of the association of which I have the honour to be chairman manufacture a large number of scientific apparatus, not only in glass and porcelain, but also other goods as well. Some of these were manufacturers in this country before the war, and proved by the quality of their products that they were able to stand against foreign competition; other members have entered the scientific trade only since the outbreak of the war, mainly at the request of the Government. The difficulties they have experienced have been extremely great, but they can prove that the quality of most glassware articles turned out is equal in many respects to that of articles previously imported from abroad.

Certain complaints have reached us; these have been most carefully investigated, and in many cases we found that the complaint dealt with glassware which was not manufactured by our members, but had been sold without any mark or badge of the manufacturer. Our members will be only too pleased to co-operate in every possible way with scientific workers, and look to them for the help necessary in establishing this "key" industry and placing it on a thoroughly sound basis.

As regards State aid, we do not want this in the form suggested, but rather we desire the creation of some method by means of prohibition whereby the industry will be enabled to establish itself, and at the same time the customer will not be penalised by being unable to get his material or the quantity of apparatus he desires. Under the form of prohibition which has been suggested, all orders for apparatus from abroad would have to come before a Special Committee of the Board of Trade. This Committee would

issue licences for all articles which were not made in this country either in sufficient quantity or of approved quality. At the present moment the rate of exchange is such that British manufacturers cannot compete even under the most up-to-date methods of manufacture, and it must always be borne in mind that this is a new industry which has not had time to establish itself or to get over the experimental stages of glass as an industry.

DOUGLAS H. BAIRD,
Chairman.

The British Chemical Ware Manufacturers' Association, Ltd., 51 Lincoln's Inn Fields, London, W.C.2, May 18.

Mortlakes as a Cause of River-windings.

MR. T. S. ELLIS asks us in NATURE of April 29, p. 264, to believe that the curves of a meandering river, instead of being wholly secondary features, are to a large extent primary, arising from the simplification of a "complicated network of channels." He admits, however, that such a network does not occur in existing rivers, and it will require more than deductive reasoning as to what should happen on a newly exposed land surface to prove that it belongs to any stage of their evolution.

On our sandy and muddy shores we have abundant opportunities for studying inductively the genesis of new stream-systems; and the general resemblance between these transient formations and the river-systems which we regard as youthful lends strong support to existing theory. In these primitive streamlets islands are not uncommon, but they are almost always of narrow lenticular form, with the lens-angles pointing up- and down-stream, and the lateral curves moderate. Save, perhaps, in a few exceptional cases, nothing approaching the sweeping curves of a meandering river is ever seen, and a whole volume of inductive reasoning goes to show that such curves belong to the stages of maturity and old age. How far the "primary consequent streams" approach and how far they deviate from straight lines depends largely upon the angle of slope: and this again, on our shores, is often conditioned, quite apart from the coarseness of material, by the rapidity of the tidal movements; for example, the drainage of the mud-*flats* of Poole Harbour is quite distinct from that of the mud-*banks* of the Wye near Chepstow; but there is surely sufficient ground for believing that regional uplift has sometimes been comparatively rapid, and in such circumstances straight consequent streams would be the rule.

Even in Mr. Ellis's special case of Mortlake his conclusions are by no means free from objection. In the first place, admitting the former existence of an island, Mortlake would lie at the head of it, and therefore quite outside the area of the "mort-lake" (as defined by Mr. Ellis) now represented by the Beverley Brook. Secondly, it is surely unreasonable to attempt to evolve primary laws from such obviously secondary conditions as we find on the flood-plain of the Thames.

Lastly, I should like to point out that, even when islands occur, their secondary nature is frequently obvious, and that there are many cases in which one of their limiting channels is due, not to the main river, but to a tributary captured by it. Jumièges, on the Seine, affords a fine example of such capture, but the island has become an isthmus. Between Datchet and Old Windsor the island and backwater ("mort-lake") are retained. I am not in a position to say whether the Beverley Brook has been similarly captured and then set free again, but such a double change is not impossible. HENRY BURY.

Mayfield House, Farnham, Surrey, May 1.

Science and the New Army.

THE two letters on this subject in NATURE of April 22 raise some points of considerable interest.

It seems clear that any attempt to train the main body of Army officers thoroughly in science and in scientific methods will be fruitless under present conditions, while it is even more certain that any attempt to train General Staff officers as scientific experts is extremely undesirable. It is, in fact, the duty of the General Staff to rely on its technical corps for advice, and it is unsound in principle and in practice for the General Staff to include within itself a separate body of experts.

On the other hand, the General Staff should possess a wholesome regard for the results which can be achieved by scientific methods, and this regard is all that is necessary to the General Staff, though the technical corps should be strengthened by the addition of scientific experts.

There appear to be three totally different Army requirements, namely:—

1. An organisation permitting the utilisation, so far as possible, of the services of scientific and technical men in time of war: (*a*) in the Army, through the Territorial Force and Officers Training Corps; and (*b*) outside the Army, as advisers in a civilian capacity.

2. An organisation which in peace time will keep the technical corps in close touch with the progress of science. This organisation would preferably be associated with the Research Department or Departments of the War Office.

3. Training of the general body of Army officers and the General Staff in scientific methods.

No attempt should be made to convert General Staff officers into scientific experts, for the reasons given above; in the nature of things, the General Staff officer *must not* be a specialist.

There seems to be every desire on the part of men of science to assist the War Office to the best of their ability; it rests with the War Office to prove that it has a sincere desire to avail itself of the opportunities offered.

C. S. WRIGHT.

1 Royston Road, Richmond, Surrey, May 5.

Waage's Phytochemical Synthesis of Phloroglucin from Glucose.

IT is generally stated that phloroglucin is formed by floating leaves in sugar solutions when exposed to sunlight. This phytochemical conversion of an aliphatic chain into an aromatic ring-compound is based on observations published by Waage in 1890 (*Berichte der deutschen botanischen Gesellschaft*, vol. viii., p. 250), which have found their way into nearly every text-book on the subject (compare, for example, M. Wheldale Onslow, "Practical Plant Biochemistry," p. 7, which has just been published). The fascination of this simple experiment and its general importance to plant chemistry have made me repeat it every summer for the last fifteen years, but not in a single case, out of nearly eighty experiments, did I succeed in detecting even the slightest trace of phloroglucin. For the detection of phloroglucin I used the pine-wood test, as recommended by Waage, and also the bromine-water test after extraction with ether.

It seems to me, therefore, desirable that this very important experiment of Waage's should also be re-investigated by others interested in this question with the view of either definitely confirming or contradicting it. M. NIERENSTEIN.

University of Bristol, May 8.

The Development of British East Africa.[1]

IT may be claimed for Lord Cranworth's volume that in a large measure it fulfils the author's main object of placing before intending settlers in British East Africa information and points of view which should be helpful to them. To this end the chapters dealing with agricultural and industrial prospects, primarily in the highlands of the Protectorate, furnish detailed information such as the most suitable areas as to soil and climate; the cost of land, labour, equipment, etc.; the requisite capital for various enterprises; and the return which may be anticipated.

There is one serious omission, however, in that no reference is made to the financial difficulty resulting from the enhanced exchange value of the rupee. This serious handicap to new settlers had not arisen when the author wrote "A Colony in the Making," from which he produced the book now under review as a revised edition; but, since the later volume was not published until 1919, it is surprising that the currency question was not dealt with as a new chapter, or at any rate referred to in the author's preface.

Lord Cranworth points out that the book is not an erudite work, but gives a few plain facts and suggestions for the guidance of those without experience of British East Africa. The usefulness of the book is enhanced by Lady Cranworth's contribution of a chapter giving not only hints on equipment for women, but also a description of the life in the highlands of East Africa, with its varied interests for women, and advice as to the suitability of the climatic and other conditions to women and children. The author himself devotes a chapter to the educational facilities at Nairobi and other centres, which should be helpful to intending settlers who are married.

A short history of East Africa, together with some notes on the native races and the effects of immigration from India, Arabia, and Somaliland, forms an interesting basis to the general description of subsequent developments and future prospects.

An ox being hyperimmunised to rinderpest. From "Profit and Sport in British East Africa."

Several chapters deal with big game and with sport and games of many kinds; those on big game furnish information as to the localities where various species are to be found, and how their presence affects the settler, while a chapter is devoted to beasts which the author would place in a black list as having many undesirable proclivities and nothing which may serve to counterbalance their disadvantages. Reproductions of Mr. J. G. Millais's "Buffalo" and his picture of animal life on the Loieta Plains are included in the illustrations.

To those interested in stock-raising an appendix giving notes on remedial measures against stock

[1] "Profit and Sport in British East Africa." Being a Second Edition, Revised and Enlarged, of "A Colony in the Making." By Capt. The Lord Cranworth. Pp. xvi+503. (London: Macmillan and Co., Ltd., 1919.) Price 21s. net.

diseases, compiled by the Chief Veterinary Officer of the Protectorate, should be read in conjunction with the author's chapter on cattle. With reference to measures adopted to combat the spread of rinderpest, there is an interesting illustration showing the method of hyperimmunising cattle.

The book concludes with a chapter detailing the assistance furnished by British East Africa and the sacrifices made by both Europeans and natives in furtherance of the military operations which resulted ultimately in the conquest of what is now known as Tanganyika Territory.

Those who, like Lord Cranworth, have the interests of British East Africa at heart will welcome this volume, with its purpose of bringing to the Protectorate an influx of recruits of the right standard requisite to further the development of its resources, particularly in view of the existing demand for the raw materials required in the reconstruction of the Empire's industries.

Weather Notes of Evelyn, Pepys, and Swift in Relation to British Climate.

By CAPT. C. J. P. CAVE.

THE interest in weather notes from old diaries lies in the fact that they may throw some light on the vexed question whether meteorological conditions in Western Europe are changing. The diaries of Evelyn and Pepys have been quoted by both believers and unbelievers in changing conditions, and it must regretfully be admitted that the question is, as yet, by no means easy to answer. Evelyn's diary extends from 1620 to 1706, but during this long period there are, on the average, only about eight weather notes to every three years. As a rule, we find only very outstanding phenomena recorded, such as serious droughts, great storms, or hard frosts. Evelyn's diary has, however, never been published in full, and it is quite possible that the complete diary may contain a great deal more information on the subject. Pepys's diary extends only from 1660 to 1669, and is, therefore, too short to enable us to draw any safe conclusions. His weather notes are, however, far more numerous than Evelyn's, there being remarks bearing on the weather on an average of sixty-two days a year. Like Evelyn, he mentions outstanding features, but he also frequently mentions the weather as it affected his movements or his health, so that we get a much better record for the few years during which Pepys kept a diary than we do for the longer period from Evelyn. Neither writer is by any means infallible in his recollection of past weather, and both can be confuted from their own writings regarding events that they describe as unprecedented in their memories.

The most significant facts from which to gauge weather conditions, in times before instrumental readings, are hot summers, droughts, wet spells, and cold winters. So far as hot summers are concerned, we have little to go on. Both writers complain of the heat at times, but the only really exceptionally hot summer seems to have been that of 1698, mentioned by Evelyn. Nor do we get very much ground to go on in droughts and wet spells. We are, therefore, restricted to cold winters, and especially to the freezing of the Thames, for evidence of any change in climate between the seventeenth century and the present time. The evidence was discussed by several writers in *Symons's Meteorological Magazine* in 1911 and 1912, and different writers came to diametrically opposite conclusions. Mr. Walter Sedgwick maintained that the intensity of falls of snow was likely to be exaggerated by the seventeenth-century diarists, for when roads were normally bad, traffic would have been far more seriously affected by snow than it is to-day. Mr. W. H. Dines, on the other hand, contended that when roads were always bad during the winter, "it was a matter of indifference whether roads were blocked by snowdrifts." It is also said that the number of references to snow in Evelyn's diary are very few, but it is quite certain that we do not find references to snow on nearly all the occasions when it occurred. In December, 1648, Evelyn says: "This was a most exceeding wet year—neither frost nor snow all the winter for more than six days in all"; but none of these six days are otherwise mentioned in the published diary. The winter of 1657–58 was extremely cold, and it is almost certain that there must have been snow; but none is specifically mentioned.

It is certain that the Thames in London froze more often in the seventeenth than in the nineteenth century, but some hold that this was due to the fact that the river was not embanked, and that Old London Bridge offered such an obstruction that the water above the bridge froze more easily than it does to-day. The Thames in London is recorded to have been frozen, or nearly frozen, on seven occasions during the period over which Evelyn kept his diary, and it is almost certain that it must have been frozen also in 1658. It is noticeable that the freezing in November, 1662, is mentioned by Evelyn, but not by Pepys, while the freezings of December, 1665, and January, 1667, are mentioned by Pepys, but not in the published diary of Evelyn. It seems as though the freezing of the Thames was not looked on as such a very out-of-the-way event, while slight frosts or small falls of snow might pass unnoticed. There were, of course, winters when there was little or no frost or snow, but they were looked on as very exceptional, and caused much apprehension as likely to "threaten a plague," and fasts were ordered by Parliament to pray for "more seasonable weather."

From the evidence in Pepys's diary the present writer thought at first that "there seems no reason to suppose that the weather" in the seventeenth

century "differed much from that to-day,"[1] but a further consideration of Pepys's notes, taken in conjunction with those of Evelyn, has led him to modify his views, and he now thinks that, on the whole, there is a good case for supposing that the winters in the seventeenth century were more severe than they are to-day. Sir John Moore, it is true, maintained in a paper, "Is our Climate Changing?" read before the British Association (Section A) in 1908, that the British climate is not changing; his evidence is based mainly on observations during the nineteenth century, with some from the eighteenth; but the constancy of the climate during the nineteenth century does not seem to preclude a change having occurred since the seventeenth, nor does it follow that a change should be progressive.

There must, however, be a good deal more evidence in scattered letters or diaries that will in time throw more light on this important point. In Swift's "Journal to Stella," which extends only from 1710 to 1713, there are weather references on seventy-eight days a year. The period is short, but I think it bears out the contention that winters with little frost or snow were exceptional. On December 27, 1710, Swift writes: "Did you ever see so open a winter in England? We have not had two frosty days." This was probably a *façon de parler*, for at least two frosts are mentioned previously, and one fall of snow. By a frosty day it must be supposed that the diarists meant more than a slight morning frost of one or two degrees in the screen. If this is so, the warmth of the early winter in 1710 was not very exceptional, judged by present-day standards. December 27, it must be remembered, corresponds to January 8 new style, but in the last fifteen years during which the writer has kept climatological records there have been four, if not five, winters when there has been no frost worth speaking about until after the middle of January, in Hampshire at any rate, and these were probably as "open" as the winter of 1710.

Swift, on the whole, takes rather more interest in the weather for its own sake than does Pepys. He compares notes with "Stella" on the difference between the weather in Ireland and in London, but, of course, most of the references concern the weather as it affected him personally. There are many complaints of cold, wet, and heat, and Swift seems to have had a constitution that was much affected by hot weather. It is curious to find that bad weather is frequently made an excuse for dining with Mrs. Vanhomrigh at the time when Swift was beginning that acquaintance with her daughter "Vanessa" which was fraught with so much tragedy.

[1] Quart. Journ. Roy. Met. Soc., vol. xlvi., p. 68.

Optical Instruments in Industry.

OPTICAL instruments, which proved their worth in war, are now being more and more utilised in developing the arts of peace. A short account of some of the chief applications of these instruments to industrial requirements, especially the more recent uses, may therefore be not without interest at the present time.

Passing over the microscope with a brief reminder of its modern use, in metallurgy, for showing the structure of iron and other metals, one of the first instruments to note is the refractometer. In many chemical works this, in one form or another, is invaluable as a means of controlling the various operations, by reason of the simplicity of its manipulation and the rapidity with which the results are obtained. The refractive index suffices in numerous instances to determine the strength of chemical solutions. It is ascertained in a few minutes, and only a drop or two of liquid is required for the purpose if an instrument of the Abbe type is employed. No weighings are involved, and no calculations if the temperature is suitably controlled, so that liability to error is greatly minimised. The instrument is thus almost an ideal one for the control of works operations where the degree of strength or purity of a product is required to be ascertained by means of rapid tests, or where a process has to be stopped when the product has reached a certain stage. Specific gravity determinations or simple chemical titrations are often used in such cases, but the refraction method is always quicker, is generally more accurate, and sometimes possesses other marked advantages. Thus the strength of an aqueous solution of nicotine can readily be obtained, correct within about 0·1 per cent., by the refractometer, whereas the specific gravity method is of no value in this instance, and titration results are vitiated if other basic substances, such as ammonia, are present.

Acetic acid, acetone, ammonia, ammonium sulphate, carbolic acid, cream of tartar, glycerin, and saltpetre may be mentioned as products, made on a large scale, for which the instrument is useful. In the brewing industry the determination of alcohol, extract, and original gravity of beer is readily made by means of the refractometer. In the fats and oils industries, in the fractionation of petroleum products, in the distillation of tar oils, and in the manufacture of many pharmaceutical articles, the refractive index is a valuable aid for controlling the purity of the materials and finished products. It is useful also in the manufacture of various viscous mixtures or semi-solid pastes, in order to determine whether the constituents have been adequately mixed, and thus to obviate local excess or deficiency of the active ingredients.

The polarimeter is an instrument constantly in use for the evaluation of essential oils, whilst makers of starch products, tartaric acid, and alkaloids frequently have recourse to it, and a

specialised form of the appliance, the saccharimeter, is practically indispensable in the sugar factory.

Mention must also be made of the simple polariscope in its application to the glass industry, where it is employed for detecting strains in glassware due to faulty annealing. Not infrequently glass articles, imperfectly annealed, are destroyed on the cutting-wheel after a good deal of time has been spent on their partial decoration. Use of the polariscope to detect strains is not new; makers of optical glass have, naturally, long availed themselves of it; but as regards ordinary glassware the method has been brought more prominently under notice as a result of war conditions, and the "strain viewer" is now becoming more generally known in glass works. The principle involved is merely that of the well-known transmission of polarised light through crossed Nicol prisms when crystalline or semi-crystalline material is placed between them. Well-annealed glass leaves the field of the instrument practically uniformly dark; strained glass produces patches or bands of light, the intensity and colour of which give some idea of the amount of strain.

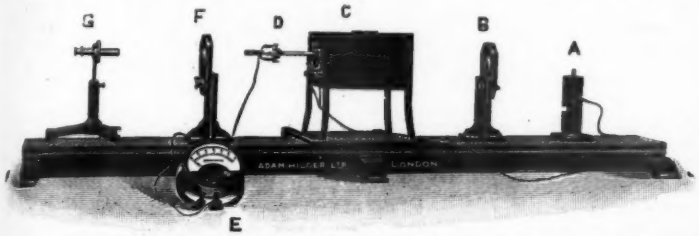


FIG. 1.—Twyman's apparatus for the determination of annealing temperatures. A, B, F, G, optical system; C, electrical furnace; D, pyrometer; E, temperature recorder.

In this connection it may also be mentioned that certain other faults in glass can readily be detected by means of X-rays. This discovery has proved very useful in making the best qualities of optical glass, by preventing the use of material in which "air-blows" had formed.

Twyman's apparatus may also be noted here. It is used for determining the annealing temperature of glass (Fig. 1). The method evolved for this purpose is applicable also to metal objects, so far, at least, as the removal of stress is concerned. Trouble during the machining of metals such as manganese-bronze, owing to distortion through stress, might often be obviated by proper annealing of the articles.

Among recent developments, perhaps the most notable is the fact that the spectroscope, in one adaptation or another, is beginning to take a definite place as an adjunct to industry. This follows upon the progress which has been made in fitting the instrument to quantitative work. In fact, it is the spectrometer, rather than the spectroscope proper, which is proving its value to the manufacturer. Hartley's work on quantitative spectrum analysis, dating from the eighties of last century, may be regarded as the pioneer investigation. He showed that the ratios of the intensities of lines in the spectrum of an element do not remain constant whilst the quantity of that element is decreased, and he introduced the term "persistency" to indicate whether a particular line appears at a definite concentration of the substance emitting it—*e.g.* 1 per cent., 0·1 per cent., and so on, of the total material under examination. This work of Hartley's was followed by that of Pollock and Leonard in Dublin, and of Gramont in France—to mention only three names out of many. Meanwhile, the earlier forms of spectroscope have given rise to the more perfect "constant deviation" wave-length spectrometer and the quartz spectrograph, with the result that it is now practicable even to carry out quantitative analyses of metals by means of their spark spectra (Fig. 2).

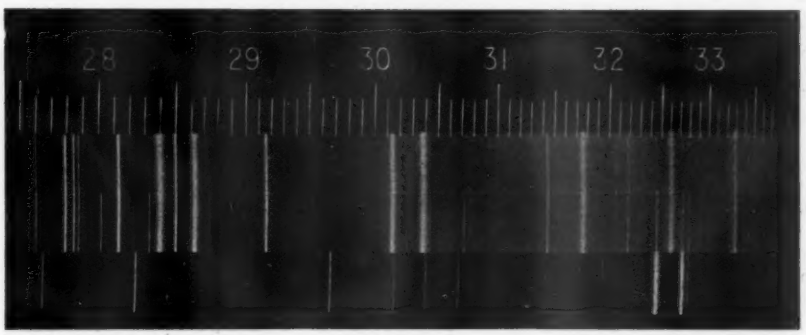


FIG. 2.—Print from negative taken on spectrograph with wave-length scale. Top strip, sample of reputed "pure tin." Middle strip, sample of commercial tin. Bottom strip, short exposure of copper spectrum. The presence of copper in the commercial tin is shown by the presence in the corresponding spectrum strip of the two copper lines at 3247 and 3274. A trace of copper is present in the "pure" tin.

Gramont uses two types of sparking apparatus (see *Comptes rendus*, 1918, clxvi., 95). In one of these the substance under examination is contained in a crater formed in one pole of the apparatus; in the second type the substance is fused in a platinum vessel, a spark being passed from a thin rod into the fused material.

This method has been used by M. Nicolardot in the chemical laboratory of the Technical Section, French Artillery, and according to Gramont it gives very satisfactory results in the control of chemical analyses. The spectrograph has also been for some time in use at the Bureau of Standards, Washington, for determining small quantities of impurities in tin and in the analysis of steel, especially as regards chromium and titanium. For estimating small quantities of elements such as niobium and molybdenum, the spectrographic method is, indeed, stated to be more trustworthy than chemical analysis.

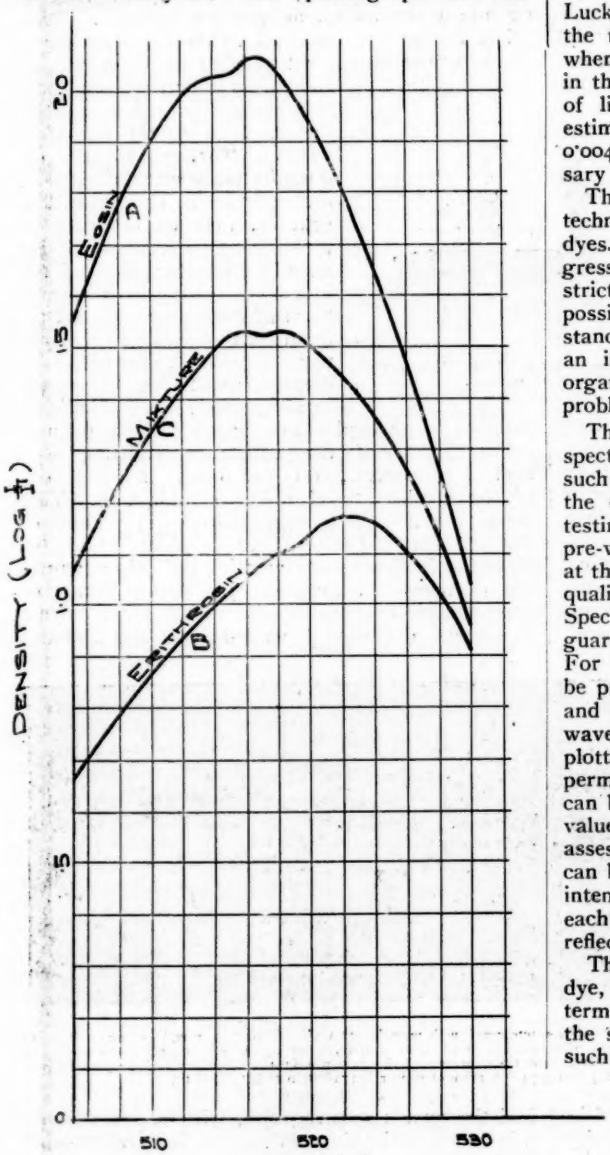


FIG. 3.—Curves plotted from results obtained in examining dyes with the spectrophotometer.

Another analytical method for metals has been described, depending upon a difference in volatility of the elements present. The authors (Hill and Luckey) use the "arc" discharge, and measure the time required for a given line to disappear when a known weight of the material is burned in the crater of the arc. Though this process is of limited application, it can be used for the estimation of lead in copper, within a range of 0·004 to 0·216 per cent., with the accuracy necessary for the work of a copper refinery.

The spectrophotometer, too, is now finding technical application, especially in connection with dyes. As the study of absorption-spectra has progressed, means for making the observations more strictly quantitative have developed also. The possibility of measuring the absorption of a substance for light of each wave-length is, in fact, an important addition to the resources of the organic chemist in dealing with certain technical problems.

The apparatus employed is a spectrograph or spectrometer combined with a suitable photometer such as the "Nutting" instrument. It is used in the control and analysis of dyes, the chemical testing of which is often a difficult matter. In pre-war days purchasers of dyes were very much at the mercy of foreign dye-makers as regards the quality and strength of dyes sent to them. Spectrophotometry can now be employed to safeguard the interests of the user in this respect. For example, a solution of known strength can be prepared from a trustworthy specimen of dye, and its colour-density determined for a series of wave-lengths by the spectrophotometer; a curve plotted from the results can then be kept as a permanent reference with which future supplies can be compared. Similarly the colour-producing value of a dye with various illuminants may be assessed by means of the instrument. Dyeing tests can be quantitatively controlled by comparing the intensity of reflected light from the dyestuff in each part of the spectrum with that of light reflected from a white surface.

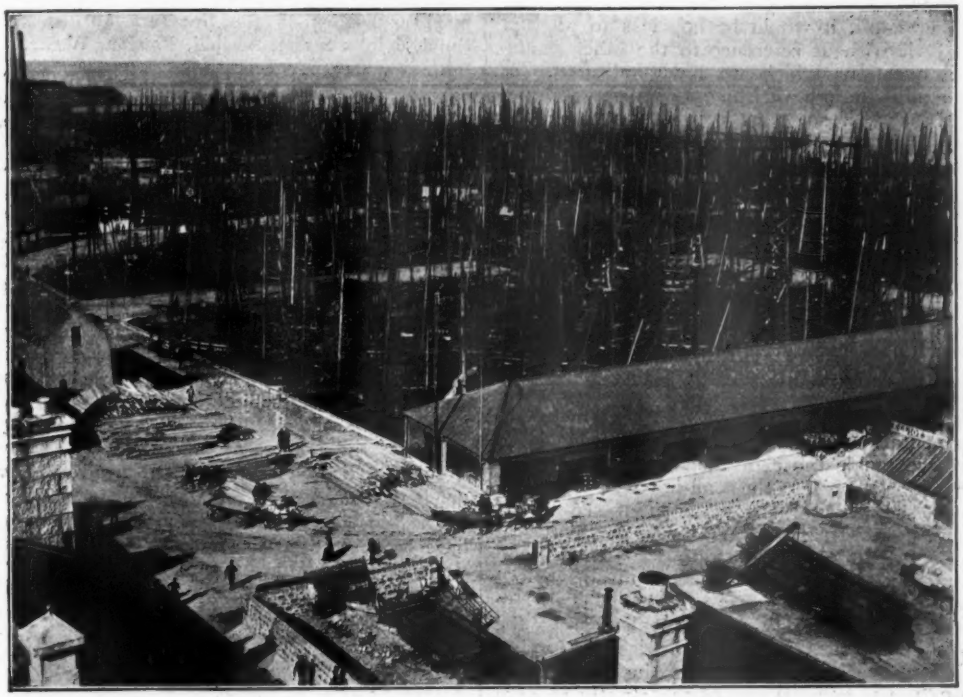
The proportion of diluent substance added to a dye, or of two dyes in a mixture, may also be determined by reference to standard curves. Thus in the subjoined diagram (Fig. 3), A and B denote such curves for known strengths of eosin and erythrosin respectively, and C is a curve given by a mixture of the two substances, in unknown proportions. By taking ordinates for two suitable wave-lengths, two equations can be formulated, from which the proportions of the two dyestuffs in the mixture are calculated. From these examples the value, actual and potential, of the instrument to the dyeing industry will readily be understood.

Of other technical uses to which special instruments are applied, a brief mention must suffice. Thus in the iron and steel industry certain rapid

sorting-out tests can be made with the grating spectrometer and with the quartz spectrograph, whilst the projection comparator is a valuable aid, in engineering, for the ready optical gauging of interchangeable parts, such as screw-threads. An important development, too, is the use of radiography in the examination of metals; but this need not be dealt with here, as it was referred to in an article on "Industrial and Medical Radiology" in NATURE of February 26.

The British Sea Fisheries.[1]

THE latest book on the sea fisheries comes most opportunely at a time when everyone interested in these matters is looking for a policy. For the last two years a multitude of committees and conferences have been considering a situation that has become acute as the result of war conditions, but which was rapidly developing even in 1913. There was then a great recrudescence of interest in the longshore and inshore fishermen; there were the perennial questions of the impoverishment of the fishing-grounds and of how this might be averted; and there were indications, even then, of troublesome problems relating to the distribution and marketing of the fish caught.



The herring fleet in Fraserburgh Harbour. From "The Sea Fisheries."

There is no doubt at all that it is these latter difficulties that have been accentuated by the circumstances of the last two years. Such things as landing facilities, railroad and motor transport, market accommodation, cold storage and curing in order that gluts of fish might be utilised, cost of new construction, labour troubles, etc.—these are the matters that immediately and personally concern those engaged in the industry. The conditions are very different from those that obtained half a dozen years ago. Then there was practically no control; but one Government Department now has to do with railway facilities; another fixes wholesale and retail prices; while others again have to do with regulations of many kinds. The result is, for the present at all events, a confusion which is apparent to almost everyone.

Under our economic conditions the profit-factor in industry is still the dominant one. The bulk of the fish landed are caught in order that they may be sold so as to yield a "return" on the capital invested; otherwise no fish would be landed except the small fraction taken by individually owned boats and longshoremen who work for a living and sell their fish for whatever it will bring. How is the deep-sea fishing industry to be carried on so as to yield a sufficient profit?

1 "The Sea Fisheries." By Dr. J. T. Jenkins. Pp. xxxi+299. (London: Constable and Co., Ltd., 1920.) Price 24s. net.

Long ago we should have left *that* question to the trade itself, but it is now clear that a policy of *laissez-faire* is no longer possible. The people must have food. The State has already taken partial control, and the logical development of such conditions seems to be the public organisation of the means of distribution and, if so, the control of profits as well as of prices.

Dr. Jenkins does not deal with these latter-day economic questions. The conditions are transient, and it is quite impossible for any man to get trustworthy information tending to elucidate them. Probably no administrator or office is big enough to deal adequately with the difficulties of the moment, and the situation must be left to resolve itself in the near future. On the other hand, it would be hopeless to attempt to study it without reference to the other fundamental questions which we have indicated. Is there really an impoverishment of the fishing-grounds, and, if so, what restrictions are necessary that this may be avoided? Regulation being necessary, what is the best form of administration? What is industrial efficiency as applied to the fisheries? Judged by the ratio of fish caught to the man-power employed, the inshore and long-shore fishermen are inefficient, and their methods wasteful. But, that being so, is it in the national interest that a prolific, hardy, and versatile stock should be allowed to decline? What, above all, are the nature and value of the information which we use in order to decide upon these matters?

Even in present circumstances, then, there are fundamental problems that must be considered before we tackle those of the moment, and it is these with which the author deals. He gives a summary of the methods of sea-fishing employed in Great Britain, and an historical sketch of the development of the trawl- and herring-fisheries. This is based on prolonged literary research and is very well done. There are a summary of the legislation applicable to the industry, a short account of the British and foreign administrations, and a *résumé* of the chief results of the fishery commissions of the strictly modern period. A well-selected bibliography should enable the reader to follow the various discussions in greater detail than that which falls within the scope of the book. It is very proper that considerable weight should be given to the scientific side of the subject, and in his introduction the author deals most conveniently with the situation of the industry at the close of the war period, especially with regard to the reconstruction of the national administrations and the development of an adequate machinery for scientific and economic investigation. Altogether, the work is one that must be considered quite essential to anyone who seeks to discover, beneath the confusion of the moment, the natural conditions upon which the continued development of the national sea fisheries, as a whole, must necessarily depend.

J. J.

Notes.

THE annual meeting of the British Science Guild will be held at the Goldsmiths' Hall on Tuesday, June 8, at 3 p.m. Lord Sydenham, president of the Guild, will deliver an address on "Science and the Nation," and the president-elect, Lord Montagu of Beaulieu, will speak on "Some National Aspects of Transport." The adoption of the report on the Guild's work since the last annual meeting will be moved by Lord Bledisloe, and seconded by Sir Gilbert Parker. The Guild is extending its activities in several directions, and all who believe in the application of scientific knowledge and method to national affairs of every kind should give it support. Tickets of admission to the annual meeting may be obtained upon application to the Secretary, British Science Guild, 6 John Street, Adelphi, London, W.C.2.

AT the Imperial Entomological Conference to be held in London on June 1–11, the subjects to be discussed, although mainly relating to agriculture, are not the less on that account of great general interest, and ought to make a wide appeal. Mr. H. A. Ballou, just returned from an investigation of them in Egypt, will read a paper on "Cotton Pests," a subject which he has long studied in other parts of the Empire. Dr. R. S. MacDougall will read one on "Insects in Relation to Afforestation," which is a subject greatly needing attention in our own country at the present day. There will also be read important papers on the special insect pests of tea and other crops, as well as on the local insect pests of various places within the Empire; and amongst other subjects for discussion "The Education of Economic Entomologists" should prove attractive, the more so as Profs. Maxwell Lefroy and Sydney J. Hickson have promised to give their views upon it. The meetings are all to be held at the rooms of the Linnean Society, Burlington House, and visits have been arranged to Oxford, Cambridge, and the Rothamsted Experimental Station, Harpenden. "The Work and Finances of the Imperial Bureau of Entomology" will be considered at the business meeting on the first day, when, doubtless, there will be nothing but greatly deserved praise for the work, and very serious consideration in regard to the finances. It is to be hoped that as an outcome the Bureau will be enabled to carry on, unhampered and unimpaired, the extremely valuable work it has done during the seven years of its existence.

A PAN-PACIFIC Scientific Congress has been organised to meet at Honolulu on August 2–20. The programme of the congress is directed by the Committee on Pacific Exploration of the U.S. National Research Council, and the chairman is Mr. Herbert E. Gregory, director of the Bishop Museum at Honolulu. The papers to be read will deal with the present status of knowledge of anthropology, biology, geology, geography, and related sciences so far as they refer to the Pacific Ocean, and will place emphasis on the research work which it is desirable to inaugurate. The significance and bearing of the research work on other fields of study will be dealt with in considerable detail. It is suggested that in the working out of

the problems only the ability and interest of the scientific workers should be taken into account, nationality and institutional rivalry being submerged for this purpose. Co-operation would eliminate unnecessary duplication of money and energy, and point the way to the best use of funds now available and to the utilisation of further endowments. The director of the museum is also organising a party consisting of an ethnologist, archæologist, botanist, and necessary staff, which will be stationed in 1920–21 at the Marquesas, Austral, Tongan, and Hawaian Islands to establish standards of the physical form, material culture, traditions, and languages of the Polynesians which may serve as a basis for the determination of the significance of changes produced by the overlapping of other races. A similar expedition is projected for 1921–22 westward to the Caroline Islands, to determine through what place or places the Polynesians reached their present settlements. Funds sufficient for one year's work, contributed by Bayard Dominic to Yale University, have been placed at the disposal of the museum trustees. The urgent need for a scientific study of the fast-changing Pacific is plain. It has been recognised in Australia, where a committee, appointed by the Universities of Melbourne and Sydney, has reported in favour of the establishment of fellowships in Pacific studies. If America studies eastern Polynesia, Australia still has Papua and the Western Islands.

THE preliminary programme of the annual meeting of the British Association for the Advancement of Science, to be held at Cardiff on August 24–28, has been issued from the offices at Burlington House. The previous meeting in that city was held in 1891, and there has been no meeting of the association in Wales since that date. The present president, Sir Charles Parsons, will hand over his office to Prof. W. A. Herdman, professor of natural history in the University of Liverpool, who will give in his presidential address a general survey of oceanography, and deal in detail with certain special problems and recent investigations, with particular reference to sea-fisheries, a topic not only of prime interest in connection with the food supply of the country, but also of special concern to the ports of the Bristol Channel. The programme announces a discourse at one of the general evening meetings by Sir Daniel Hall, of the Ministry of Agriculture, on "A Grain of Wheat from the Field to the Table," another pregnant subject at the present time. Sir Richard Glazebrook, lately Director of the National Physical Laboratory, will also deliver a discourse. A scientific exhibition in connection with the meeting is announced to be given in the museum exhibition room at the Cardiff City Hall, where the general reception room for the meeting will also be established. The sections will meet mostly in the University College and the Technical College, which, with the City Hall, belong to the fine range of public buildings which surround Cathays Park. Scientific excursions will be organised in connection with the work of several of the sections. A civic reception by the Lord Mayor is announced, as is also a garden party for members, given by Lord Treowen, president of the National Museum of Wales (which has its headquarters at Cardiff). Among other fixtures is a special service in St. John's Church, Cardiff, on the Sunday after the meeting, at which Dr. Barnes, Canon of Westminster, will preach.

PRINCE ALBERT will preside at the Royal Aeronautical Society's Wilbur Wright lecture, which will be delivered at the Central Hall, Westminster, on June 22, at 8.30 p.m., by Commander Hunsaker, upon the subject of "Naval Architecture in Aeronautics."

THE Academy of Natural Sciences of Philadelphia has conferred the Hayden memorial medal for 1920 on Prof. T. Chrowder Chamberlin, professor emeritus of the University of Chicago, in recognition of his distinguished services to geological science. This medal is presented every three years for distinguished accomplishments in geology or palæontology.

THE twenty-fifth annual congress of the South-Eastern Union of Scientific Societies will be held at Eastbourne on June 2–5. On the evening of Wednesday, June 2, the president-elect, Sir Edward Brabrook, will deliver his presidential address. Other items in the programme are:—The Glaciation of the South Downs, E. A. Martin; First Steps in a Local Survey, C. C. Fagg; Recent Discoveries in Insect Mimicry, Prof. E. B. Poulton; Report of Mosquito Investigation Committee; and Migration of Lepidoptera, R. Adkin.

THE possibilities of cotton-growing in South America are discussed at length by Mr. G. McC. McBride in the *Geographical Review* for January (vol. ix., No. 1). Up to the present South America has produced annually scarcely 2 per cent. of the world's total output. Mr. McBride shows reasons for believing this could be greatly increased. The principal increase must come from the eastern highlands of Brazil. In the São Paulo region it is already competing with coffee, which suffers more than cotton from frosts. Labour and transport are the factors which limit its growth at present, but as these are gradually overcome Brazil will be able to export cotton on a considerable scale. Other possible cotton lands occur in the plains of northern Argentina and Paraguay, and in the coastal valleys of Peru.

TOWARDS the end of March last a meeting was held in Brussels of the scientific committee of the Solvay International Institute of Physics, and it was resolved, upon the recommendation of the executive committee, to resume the work of the institute, which had been interrupted by the war. New physical councils will be summoned from time to time, similar to those formed in 1911 and 1913. The president referred to the debt which the scientific committee owed to Dr. R. B. Goldschmidt, of Brussels, for the services rendered by him to the institute during the early years of its foundation. The members of the committee were Prof. H. A. Lorentz (president), Haarlem; Mme. Curie, Paris; Sir W. H. Bragg, London; M. Brillouin, Paris; Prof. H. Kamerlingh Onnes, Leyden; Prof. Knudsen, Copenhagen; Prof. A. Righi, Bologna; Sir Ernest Rutherford, Cambridge; and Prof. E. Van Aubel, Ghent.

MAJORS MCKENDRICK AND MORISON have investigated statistically the occurrence of cases of influenza on shipboard, from which they deduce a mean incubation period in this disease of 32·7 hours, some 90 per cent. of the cases having an incubation period within two days (*Indian Journal of Medical Research*, vol. vii., No. 2, p. 364).

IN a general review of influenza in *Medical Science: Abstracts and Reviews* (vol. ii., No. 2) the influenza epidemic of 1918–19 in Switzerland is surveyed. It is estimated that there were 2½ million cases. The case mortality was 1·1 per cent.; 65 per cent. of the cases occurred between fifteen and forty-nine years of age, and only 5 per cent. in persons of fifty and more. The total deaths were 17,575, a much heavier death-roll than that caused by other epidemic diseases.

ATTENTION is directed in a paper by Mr. Mottram and Mr. Clarke (*Archives of Radiology and Electrotherapy*, No. 237, April, 1920) to the reduction in the number of the white blood corpuscles in those handling radium for curative purposes, a reduction amounting to ⅓–⅔ of the normal number. They estimate that the physician-in-charge receives daily about 1·4 per cent. of the total radiation received by a patient during a course of treatment for cancer, and in ten weeks the same quantity of radiation as the patient.

THE Committee on Food and Nutrition of the National Research Council, Washington, U.S.A., has just issued a report on meat and milk in the food supply of the nation which gives some interesting facts on the relative values of these two important dietary substances in comparison with the value of the food required to produce them. The Committee supports the British estimates on the same subject, viz. that the good milch cow returns 20 per cent., the poor milch cow 12 per cent., and the good beef steer only 6 per cent. of the energy-value of the food consumed. Crops grown on a given area may be expected to yield four to five times as much protein and energy for human consumption when fed to dairy cows as when used for beef production.

AN address on the work of the Medical Research Committee was delivered by its secretary, Sir Walter Fletcher, to Members of Parliament at the House of Commons on March 9, and has been published in pamphlet form by the Research Defence Society. The history of the committee was first briefly sketched. Some 50,000*l.* a year has hitherto been devoted to the advancement of medical research, but the Treasury has announced that in the immediate future 125,000*l.* per annum is to be allocated for this purpose. Sir Walter Fletcher then described some of the researches that have been prosecuted by means of these funds. A disease, bilharziasis, due to a parasitic worm, is very prevalent in Egypt. Its life-history was unknown, and Dr. Leiper, of the London School of Tropical Medicine, was sent out to investigate. He found that the bilharzia worm passes part of its life-cycle in certain fresh-water snails, from which larval forms hatch out; and these constitute the infective agents. They soon die, however, unless they enter the human host, so that water kept for twenty-four hours is safe. This work cost less than 500*l.*, but bids fair in time to eradicate bilharziasis. Trench nephritis, a kidney disease, was very prevalent during the war. Investigations into its causation indicated that it is probably of an infective nature. Means were devised by which the efficiency of the kidney could be gauged, and it was possible to decide which of the thousands of cases at the base hospitals were likely to grow worse and should be sent home, and which could probably soon go back to duty. The same tests have been employed since in judging claims for pensions based upon supposed damage to the kidneys. By this means it is estimated that the Pensions Ministry has saved, during the first year, no less than 150,000*l.*; yet the total cost of this piece of work was somewhere between 2000*l.* and 3000*l.* Sir Walter Fletcher put in a plea for the better remuneration of scientific research, and the address was followed by an interesting discussion.

IN the *British Journal of Psychology* (vol. x., March) Mrs. S. Brierley discusses the present attitude of employees to industrial psychology. She finds, in talking to working-men, much opposition to the suggested introduction of psychological methods into industry—an opposition which cannot be dismissed as characteristic of the more ignorant and less skilled workman. Several reasons for this attitude of mind are considered, of which the most vital seems to be the not unreasonable fear that the introduction of these methods will inevitably lead to an increase of monotony and a diminution in the possibility for initiative or creative work on the part of the individual worker; some of these so-called scientific methods do seem to imply that the manager is to be the brains of the machine, and the worker merely the muscles. It is unfortunately only too true that some enthusiastic exponents of these methods have allowed their enthusiasm to limit their point of view to increased production, and in so doing they have lost sight of the effect on the individual worker. The problems of monotony, mechanisation, specialisation, and self-government must be considered not only as bearing on increased output, but also as affecting the whole development of the worker; work must offer an outlet for the healthy satisfaction of the creative impulse. The author raises many problems connected with present-day industry and shows what psychology as applied to industry has to face before it can win the whole-hearted support of the workers. The paper should prove interesting to all whose scientific work brings them into contact with individual workers in industry.

SINCE the early experiments of Cuénot, Castle, Miss Durham, Little, and others on the inheritance of coat-colour in mice, these animals have been a favourite subject for the study of spotting as well as of self-colour. In a recent paper by Sô and Imai (*Journal of Genetics*, vol. ix., No. 4) the authors distinguish two factors concerned in spotting, one of which (D) is epistatic to self-colour, which it modifies to the "Kasuri" pattern characterised by fine silvered

markings. When the recessive spotting allelomorph (S′) of self-colour (S) is present with the epistatic factor, a white animal with dark eyes known as "Daruma" (snowman) is produced. Mice which are homozygous for D fail to develop whether S or S′ is present in addition. D is, therefore, a lethal factor, and can only appear in the heterozygous condition, as is well known to be the case with yellow mice. By this analysis it is shown that a varied and apparently continuous series of stages from dark-eyed white through spotting to self-colour depends upon two pairs of factors.

MR. T. W. VAUGHAN furnishes a comprehensive account of the American Tertiary, Pleistocene, and Recent coral-reefs in Bulletin 103 of the U.S. National Museum, pp. 189–524, 1919, as the fore-part of a paper describing fossil corals from the zone of the Panama Canal. No naturalist—and in this term we of course include the geologist who strives to understand the past—can afford to overlook this important summary of recent work. Some readers may be startled by the statement that "the theoretic possibility of the progressive change of a fringing reef into a barrier, and later into an atoll, according to the Darwin-Dana hypothesis, may not be denied, but no instance of such a transformation has as yet been discovered." But the author again and again emphasises the upward growth of coral-reefs in keeping pace with the submergence of the platforms on which they first arose. The discussion of these platforms and of their pre-Glacial age is full of interest; but Mr. Vaughan rightly points out that the question of their modes of origin does not affect the question of reef-growth. Murray's theory of solution to account for lagoon depths is regarded as "entirely disproved," and every credit is given to Dr. Guppy and Admiral Sir J. Wharton for their views on the relation of reefs to submarine platforms. The corals that result in barrier-reefs flourish, as Guppy urged, at some distance from a shore, because they are there removed from deleterious sediments; the reef thickens, as Wharton perceived, by submergence of its base. In the case of Australia, though not as a general proposition, Mr. Vaughan believes that this submergence can be accounted for by the rise of water during "deglaciation." The effects of drift-currents in developing and controlling the form of atolls on an open platform may be regarded as well established.

THE Italian State Department has now resumed publication of its Reports of the Aeronautics Experimental Institution (*Rendiconti dell' Istituto sperimentale aeronautico*). No. 1 of the new series just to hand contains an exhaustive article on the treatment and preservation of wood. The first part of this important monograph deals with the botanical aspect of the subject; the second part with the theory of timber preservation, including drying and seasoning; the third part with the practical side of timber seasoning and impregnation with preservatives; while part iv. is devoted to methods of testing (both physical and mechanical).

MEASURES are being taken to reorganise and extend various scientific services in French Indo-China. M. Aug. Chevalier, writing in *La Géographie* for April (vol. xxxiii., No. 4), gives some account of the plans. The agricultural, forest, and survey departments had fallen into neglect when the present governor-general in 1917 took steps to revive them. Several experimental agricultural stations and agricultural schools have been founded, and this year work was begun on the building of a central scientific institute at Saigon, to which the agricultural service of Indo-China and the botanic gardens at Saigon are to be attached. The institute will conduct experiments in the growth of rubber, coffee, tea, and rice; study the flora and products generally of Indo-China; and conduct researches on plant diseases. It is also proposed to start a marine station. The Government has provided funds for a scientific library and the issue of a monthly agricultural bulletin.

No. 23 of the Proceedings of the Dutch Meteorological Institute is devoted to three papers by Miss A. van Vleuten on the possibility of accounting for the daily variations of the earth's magnetic field by a system of electric currents external to the earth and the currents within the earth's surface induced by them. In 1889 Schuster concluded that such was the case. Since that date both Fritsche and Steiner have examined the data available, and concluded that it did not support the hypothesis. In view of this difference of opinion Miss van Vleuten has again analysed the daily variation of the field, and resolved it into an external and an internal part. The two show that the principal terms of the Gauss expansion do not support the hypothesis, although the higher and less important terms are in agreement with it. In a further paper the author, by comparing the terms of the potential calculated, first, from the north component, and, secondly, from the east component of the field, shows that the daily variation of the field does not possess a potential, although it is, of course, always possible to deduce part of it from a potential.

THE physiological aspect of flying at high altitudes engages the attention of Dr. Guglielminetti in *Génie Civil* for March 20. The experiences of mountaineers, balloonists, and airmen who have flown to great heights are reviewed in turn. From tests carried out in the laboratory, and from the experience of Mosso and Agazotti (of Turin), Dr. Guglielminetti is inclined to the opinion that the physiological disturbances caused at altitudes below 8000 metres are due to anoxyphemia, and above 8000 metres to acapnia. While the use of respirators having suitable reducing-valves controlled automatically by the varying pressure at different altitudes would no doubt afford a fairly satisfactory solution, the better way lies in the design of suitable closed cabins in which the air-pressure is maintained constant by compressing the air taken in from outside. M. Louis Breguet has already suggested a design of aeroplane in which the pilot and passengers would be so enclosed. The excess of air necessary for the engine at high altitudes would probably be supplied by a turbine driven by the exhaust gases, such as has been suggested by Prof. Rateau.

THE report of the Council of the Illuminating Engineering Society, presented at the annual meeting on May 11, contains an interesting record of the past session's work. Papers and discussions dealing with photometry, camouflage, colour-matching, motor-car head-lights, and lighting conditions in mines have been arranged, the last in co-operation with the Council of British Ophthalmologists and the Royal Society of Medicine. The various committees working under the society, notably that conducting an inquiry into eyestrain in kinemas, afford evidence of similar co-operative effort. Special attention has been devoted to industrial lighting in relation to health and safety, and it is hoped that before long general statutory provision for adequate lighting will be introduced into the Factory Acts. The society hopes now to be able to resume its participation in the international treatment of illumination, and is represented in the person of its hon. secretary at the congress of the Royal Institute of Public Health taking place this month in Brussels. Following the presentation of the annual report, a paper on portable kinema outfits was read by Capt. J. W. Barber, several novel forms of apparatus being shown.

THE work of Willstätter and his collaborators has imparted considerable interest to that branch of biochemistry which includes the formation of anthocyanins in plants. A suggestive paper on the subject is contributed to the April issue of the *Biochemical Journal* by O. Rosenheim. This author has isolated in a crystalline form the red pigment of the young leaves of the grape-vine, and has shown that it is most probably identical with oenidin, the non-sugar component of the pigment of the purple grape. This is the first instance on record in which the red pigment of leaves consists of free anthocyanidin. The vine-leaves have been shown to contain also a colourless modification of the pigment, possibly in combination with a carbohydrate or other complex. For this compound the general name "leuco-anthocyanin" is suggested; it is converted into anthocyanidin by strong acids. The only representative of the family Vitis characterised by the production of free anthocyanidin is the European species, *Vitis vinifera*, and it is pointed out that this biochemical test may prove useful in the investigation of genetic problems.

AN interesting paper by Eiichi Yamasaki on "The Chemical Kinetics of Catalase" has recently appeared in the Science Reports of the Tôhoku Imperial University (vol. ix., No. 1). The property formerly attributed to all enzymes of accelerating the decomposition of hydrogen peroxide is really a specific property of catalase, which is contained as an impurity in most enzyme preparations. The catalase used by Yamasaki was obtained from the edible sprout of a certain bamboo, *Phyllostachys mitis*, Riv. The velocity of decomposition of hydrogen peroxide by catalase is, in general, proportional to the concentration of the enzyme and of hydrogen peroxide, but the activity of the catalase decreases in the course of the reaction. As to the cause of this decrease in activity, the author can only conclude that it is due to the substrate and product of reaction, hydrogen peroxide and oxygen; and the rate of decrease is approximately proportional to the principal reaction. The decrease in activity is not to be attributed to change in concentration of hydrogen ions. It has already been found that in a very dilute solution of hydrogen peroxide and a comparatively concentrated solution of catalase the relative activity increases in the first stage and then decreases gradually. This behaviour may be attributed to the facts (1) that the ordinary reaction would be carried out at a rate somewhat higher than that which is calculated according to a first-order reaction; (2) that the rate is retarded with hydrogen peroxide and oxygen in ordinary cases; (3) that such effects are observed only in the course of reaction in very diluted solutions, because the concentration of both the substrate and the product are very small, *i.e.* the velocity constant has a maximum value; and (4) that the retardation proceeds with the measurable velocity, which is approximately proportional to the principal reaction.

THE Rotary Club of London, composed of about three hundred members, each representing a different trade or profession, and connected with twenty-five other rotary clubs in other parts of the British Isles, has undertaken the urgent and important work of endeavouring to find posts for demobilised men out of employment. We are asked to direct attention to this most praiseworthy task and have much pleasure in doing so. Thousands of capable officers and men who were on active service during the war are now seeking employment, and particulars of vacancies of any kind may usefully be sent to Mr. Edward Unwin, jun., at the "Rotary Room," Horrex's Hotel, Norfolk Street, Strand, London, W.C.2.

MR. H. MARTIN LEAKE, Director of Agriculture, United Provinces, India, is publishing through Messrs. W. Heffer and Sons, Ltd., "The Bases of Agricultural Practice and Economics in the United Provinces, India," in which the history of agriculture is traced; the fundamental facts of agricultural practice and economics are described; the lines upon which agricultural practice is likely to develop are brought out, and emphasis is laid upon the fact that recent advances in scientific knowledge have made it possible for directed, as opposed to undirected or empirical, methods to be employed. It further indicates the weaknesses of the present economic system, and develops the idea of co-partnership in the land between landlord, tenant, and Government.

MESSRS. DULAU AND CO., LTD., 34 Margaret Street, W.1, have just issued a catalogue (No. 82) of an important botanical library recently purchased by them, the volumes in which are now offered separately. The works listed number 593, and many are scarce. The catalogue is one likely to interest all students of botany, and copies may be had of Messrs. Dulau upon application.

Our Astronomical Column.

ASTRONOMICAL ANNOUNCEMENTS BY WIRELESS TELEGRAPHY.—Prof. Kobold, editor of *Astr. Nachrichten*, and director of the Centralstelle, delegated the latter work to Prof. Strömgren, Copenhagen, during the war, but has now resumed it, and announces in *Astr. Nach.*, 5044, that arrangements have been made for the distribution of astronomical information by wireless telegraphy from the Nauen station. Such messages will bear the signature "Obs.," and it is suggested that institutions that wish to receive them should make arrangements with the wireless station nearest to them that receives Nauen messages. It is hoped that they will make a contribution to the cost of the service. The idea of using wireless in this manner is certainly a good one, and might be of great service in the case of such unexpected phenomena as the outburst of novæ, where early observations are of special value.

THE ASTROGRAPHIC CATALOGUE.—This great undertaking, begun a third of a century ago, is still far from completion, many of the observatories that undertook to collaborate having dropped out, from financial or other reasons. Their zones were afterwards allotted elsewhere, and one of the new observatories (Hyderabad) may be mentioned in particular for its praiseworthy energy. The late director, Mr. R. J. Pocock, unhappily died without seeing the work completed; but thanks to the Nizam's generosity the work is continuing under his successor, Mr. T. P. Bhaskaran, who has just published vol. iii., containing measures of rectangular co-ordinates of 3,743 star-images on plates with centres in decl. −19°. The form of publication is similar to that in the Greenwich and Oxford catalogues.

TIDAL FRICTION AND THE LUNAR AND SOLAR ACCELERATIONS.—Dr. H. Jeffreys has a paper on this subject in the Monthly Notices for January, in which he quotes Major G. I. Taylor's result in Phil. Trans., A, ccxx., that tidal friction in the Irish Sea accounts for 1/56th of the required dissipation of energy, assuming that the moon's secular acceleration is 10·5″ per century, which is 4·4″ above the amount calculated from planetary action on the earth's orbit. The accelerations are here measured, as is customary, by the space gained at the end of a century. Dr. Jeffreys uses the more strictly logical system of the velocity gained, and, consequently, doubles the value of the acceleration. He gives a list of the seas that seem likely to contribute to the tidal effect, and concludes that they are capable of producing the whole of it. The tidal acceleration of the moon is the difference of two terms: (1) the apparent acceleration due to the slackening of the earth's rotation, and (2) the actual retardation due to increase of distance. In the case of the sun only (1) is present, though there may be further acceleration if the earth is travelling in a resisting medium. Dr. Jeffreys finds for the solar acceleration 1·56″ on his system—that is, 0·78″ on the usual system.

Dr. Fotheringham has rediscussed the accelerations from all available ancient observations. He finds 10½″ for the moon, and 1″, or somewhat more, for the sun. The corresponding period for the large empirical lunar term is 260 years. Prof. Turner finds that this period agrees well with the periods deduced from Chinese earthquake records and from those of Nile floods. He also confirms it by statistics of tree-growth, derived from a study of their annual rings. He suggests that the earth is pulsating in this period with consequent alteration in its rotation, which produces an apparent fluctuation in the moon's motion, and smaller ones in that of the sun and planets.

The Iron and Steel Institute.

THE annual meeting of the Iron and Steel Institute, held in London on May 6-7, was rendered noteworthy by the fact that the incoming president was Dr. J. E. Stead. It is somewhat remarkable that Dr. Stead has not been elected to this office before. He has been engaged in metallurgical work for fifty years, has reached the age of seventy, and no metallurgist in this country holds a higher international reputation. He has carried out a considerable number of researches of first-rate importance which are remarkable for their suggestiveness and technique, and he possesses in a striking degree the confidence and respect of those engaged in the industry. The explanation, however, is forthcoming in the opening sentences of his address, from which it is clear that he was invited to fill this office some years ago, but refused as he did not consider he was qualified, to use his own words, "to accept such an exalted position." It is quite safe to say that this misgiving has never been shared by anyone else. Dr. Stead finally yielded to the strong representations of his fellow-members on the council, and his acceptance of the office of president has been received with widespread gratification by the institute.

His presidential address is an attempt to pass in review the progress made in the ferrous industries during the past fifty years. This proved to be a gigantic piece of work, and it is not surprising to learn that Dr. Stead found more trouble in condensing than in collecting the voluminous data so as to bring them within the limits of an address. Even so, it turned out that he was not able to read more than one-third of it. The address is divided into a series of sections which deal successively with the blast-furnace, the puddling process, science in the foundry, the basic Bessemer and basic open-hearth processes, electric furnaces, the production of sound ingots, the recognition of science, the advent and progress of metallography, the application of science to the ferrous industries, the encouragement of science, and technical education. Within the limits of this article it is only possible to touch briefly on the subject-matter of three of these sections.

(1) *Blast-furnace Practice.*—It appears from the accumulated experience of this branch of the industry that no object is gained by increasing the capacity of the furnace above 30,000 cubic feet, and that its working is best controlled by having a separate blowing engine for each furnace. Increased output per furnace can be achieved by widening the diameter of the hearth and increasing the volume of the air blown in. The gases issuing from the furnace-top should be conserved by the adoption of the double bell or some similar system. The maximum proportion of their calorific value should be used by freeing them from dust, controlling the proportion of air for their combustion, and maintaining a low exit temperature. Coke-ovens should be close to furnaces and the coke handled as little as possible after it leaves them so as to avoid the production of "fines," and should be sufficiently hard to resist crushing. Fine coke disorganises the regular working of the furnace and reduces the output of pig-iron. It should, therefore, be sieved off and either used for other purposes or briquetted, if the process be not too costly, and then charged into the furnace. Dr. Stead concludes that there is sufficient evidence to show that given efficient gas-engines it is advisable to use them in preference to steam-engines. One of the still unsolved problems is the utilisation of the heat carried out of the furnaces in the slag. Inasmuch as the gas and the heat obtained from the

blast-furnaces and coke-ovens exceed the requirements of the blast-furnaces, he regards it as probable that in cases where coke-ovens, blast-furnaces, and steelworks are grouped together sufficient gas will be available to do all the heating at the steelworks without using any raw coal.

(2) *Electric Furnaces.*—The electro-thermal steel furnace, which up to 1914 had produced only a very small proportion even of the higher grades of steel, was developed with great rapidity in this country during the war. Germany led in this branch of the industry, and most of the German electric steel was made by refining basic Bessemer steel. Furnaces of 30 tons capacity were used for this purpose. The U.S.A., Italy, and France were all ahead of England in production. To-day the U.S.A. leads, followed by Germany and England. It is stated, however, that the actual number of furnaces and the amount of power used are greater in England than in Germany. By the end of 1918 no fewer than about 140 furnaces of all types were in use in this country, with a production of 150,000 tons per annum. During the war the output in these furnaces was principally used for making steel for bullet-proof plates, aeroplanes, motor-cars, armour-piercing shells, and steel helmets. Stainless steel is being made in increasing quantities, as are also nickel-chromium and other alloy steels. The significant statement is made that on the Tyne electro-thermal steel is being manufactured at a price which can compete with the acid open-hearth steel, since cheap power is available from coke-oven gas. A great advance is foreshadowed in Dr. Stead's reference to the melting of steel *in vacuo*. Mr. Albert Hiorth, of Christiania, has designed an induction furnace of this type in which the steel is melted and then cooled. Afterwards it is removed and cut up into sections for forgings. It is stated that in this way steel free from honeycomb and gases is obtained. While it is probable that this process is likely to be, for the present, applied only to the highest qualities of steel, experience may indicate the desirability of its extension to other varieties later on.

(3) *Technical Education.*—Dr. Stead finally puts in a powerful plea for the better education of the technical staffs and workmen engaged in the industry. He mentions that many years ago he discussed and formulated a scheme with the late Mr. Andrew Carnegie whereby there was to be established in every industrial centre an institute which could be used as the headquarters of local technical societies, consisting of metallurgists, engineers, electricians, chemists, and others. At this centre proceedings of technical societies and all technical publications were to be assembled. Indexes of subject-matter would be prepared by a competent staff, and supplied to the general managers of the various industries. After many years' discussion a step in this direction has been taken in the Middlesbrough district. Suitable premises have been obtained, which are being reconstructed to meet local requirements. The sum of about 10,000*l.* has been subscribed, and there are promises of annual subscriptions. This, however, is only a beginning, and Dr. Stead, who has nothing if not vision, contemplates an annual contribution from the iron and steel industry for the purpose of making the scheme adequate. He suggests a contribution of 0·1 per cent. on the capital invested, or 1 per cent. on the actual dividends. Taking the former at, roughly, about 250,000,000*l.*, the annual charge would be 250,000*l.* A fund of this magnitude should be sufficient in his opinion to enable technical institutes to be established and maintained in the eight principal iron- and steel-making districts and in London, and to carry on their work with a "fair degree of efficiency." It is to be hoped that this suggestion of Dr. Stead's will be vigorously taken up by his council, and a serious attempt made to bring it to fruition. H. C. H. CARPENTER.

The University of London.

GOVERNMENT OFFER OF A SITE.

AT a meeting of the Senate of the University of London, held on May 18, the Vice-Chancellor, Dr. Russell Wells, reported that the Chancellor, the Earl of Rosebery, had received from the President of the Board of Education, Mr. H. A. L. Fisher, a communication in the following terms, dated April 7:—

"The Government have watched with sympathetic interest the efforts which the universities have been making to fit themselves for the task that the period of reconstruction imposes on them, and to take advantage of the opportunities for extending their usefulness which are offered by the steadily growing public recognition of the national importance of a good system of university education. Nowhere are the opportunities more favourable than in London; for as the capital city of the Empire, with the unmatched facilities for many branches of study and research which its great national collections, hospitals, and public institutions provide, London has always attracted a large number of students, not only from all parts of the United Kingdom, but also from overseas. The war has deepened the general sense of Imperial and international solidarity and has spread more widely an understanding of the mutual benefits which the different peoples derive from drawing closer the relations between their educational systems; and it is accordingly to be anticipated that in the near future many more university students will be coming to London from our Dominions and Colonies and from foreign countries. This will inevitably place a very serious strain upon the teaching resources of the University of London and will add considerably to the already grave difficulties of organisation by which the University has long been confronted. The Government have, during the past year, sanctioned large increases in the grant to the teaching institutions included in the University of London, as in the grants to the other universities and colleges throughout the country, and no doubt these additional grants should go some way towards enabling the University to meet its increased responsibilities. The mere increase of the grants to individual colleges will not, however, by itself dispose of the special problem which London University has to solve, and the Government are accordingly prepared to take a further step which they consider likely to prove of very material assistance to the University at this critical stage of its development.

"It has seemed to the Government that this is a suitable time at which to make an offer which they have long had under consideration and which they think should help to remove a good many of the administrative difficulties involved in the housing of the University headquarters in the Imperial Institute at South Kensington. The Government are now in a position to acquire a site of about 11½ acres behind the British Museum, and they offer to devote it gratis and in perpetuity to the provision of a site for new headquarters of the University and for colleges and institutions connected with it, including King's College, whose premises in the Strand are now

inadequate for its needs. It would be out of place for me to enlarge on the advantages to be expected from securing the concentration of the headquarters of the University and its two incorporated colleges on a single site, in a quiet residential quarter close to our greatest National Library and Museum, and capable of expansion in the future as the need may arise. The merits of this site, as of other alternative sites which have from time to time been suggested, have, I know, been the subject of much discussion by the friends of university education in London, and I have no doubt that the University is fully apprised of the considerations which need to be weighed. I have no desire to persuade the University against its will. No one recognises more fully than I do the right of universities to control their own destinies and shape their own policies. The responsibility for accepting or declining the Government's offer must rest wholly with the University, which alone is in a position to estimate how far the proposal I communicate to you is likely to advance what it conceives to be its true interests. The view of the Government is, I think, sufficiently indicated by their willingness to provide for the University a site of great value in the heart of London, at a time when there is no temptation to incur expenditure upon any but objects of first-rate urgency and importance.

"It had at one time been my hope that the Government would be able to offer not only the site of which I have spoken, but also the buildings for the new University headquarters: the Government have, however, reluctantly come to the conclusion that, while they are prepared to make such provision as will secure the University from loss in respect of maintenance charges on the new University headquarters, the state of the national finances did not justify their undertaking to provide the cost of the buildings themselves from public funds. They feel that in a matter in which the honour and dignity of the City of London are so nearly concerned, the University can look with confidence to the generosity and public spirit which have always marked the citizens of London: it can do this with the greater assurance that recent years have shown an increasing readiness upon the part of the great business community to respond to appeals for University purposes.

"I am aware that a matter of such importance to the University needs to be fully discussed, and that I cannot fairly expect an immediate answer to the Government's offer. At the same time the University will understand that the Government are naturally anxious to know as soon as possible whether their offer will be accepted or not, since, if it should be declined, they propose to make early use of the site for other purposes. I have, therefore, to ask that the University's answer may not be unduly delayed."

The matter was referred to a special committee for consideration and report as speedily as possible.

Genetic Studies of Drosophila.[1]

NO single animal has provided such a rich field for discovery in genetics as the little fruit-fly Drosophila (usually known as *D. ampelophila*, but now called *D. melanogaster*), and in this large and handsomely illustrated volume Prof. Morgan and his collaborators bring together the results of some of their recent work upon it. Of the four parts into which the book is divided, the most interesting is the first, dealing with the gynandromorphic specimens that have appeared in Prof. Morgan's and Dr. Bridges's experiments, and including a most valuable summary and discussion of gynandromorphism in other animals. In Drosophila it appears that about one individual in every 2200 is gynandromorphic, but these gynandromorphs are most varied in their combination of male and female characters. A considerable proportion of those described are bilateral, with male secondary sex-characters on one side and female on the other; a smaller number are "fore and aft"; while the majority are irregular mosaics, most often with a preponderance of female characters. It is a remarkable fact, however, that in Drosophila, contrary to what is usual in animals of other groups, the two gonads are always of the same sex—doubtless, as the authors point out, in consequence of the very early separation of the primitive germ-cells in the Diptera. As a result of this, it may happen that a fly is externally almost entirely of one sex while containing germ-cells of the other sex, so that Nature here confirms the conclusion reached by Meisenheimer and by Kopeč from transplantation experiments, that the sex of the gonad in insects has no influence on the secondary sexual characters. Flies externally chiefly male, but having ovaries instead of testes, court normal females, but attract males.

The authors believe that in all but very exceptional cases gynandromorphs of Drosophila are derived from fertilised eggs which would normally produce females, *i.e.* from eggs containing two X-chromosomes, and that the male portions arise from cells in which one X-chromosome has been lost through an abnormal mitosis in one of the early segmentation divisions. The evidence for this conclusion is that in almost every instance the sex-linked factors borne (according to the chromosome hypothesis) by the two X-chromosomes introduced from the parents are distributed as might be expected between the male and female portions of the fly. For example, a wild-type female (heterozygous for eosin eye and miniature wing) was crossed with an eosin-miniature male. A gynandromorph among the offspring was female on the left side, with red eyes and long wing, while the right side was male with eosin eye and miniature wing. The explanation offered is that elimination of the maternal X-chromosome on the right side allowed the recessive eosin-miniature characters borne by the remaining X-chromosome to appear. Morgan's earlier hypothesis of the production of gynandromorphs by the entrance of two spermatozoa into the egg, and Boveri's of the division of the egg-nucleus before conjugation with the sperm-nucleus, are excluded by the fact that the non-sex-linked characters borne by the two parents are not divided between the parts showing different sexes. In respect of these characters, all parts of the gynandromorph, whether male or female, bear the dominant characters, whether they are introduced by the male or female parent. The analysis of these gynandromorphs thus gives important confirmation to the theory of chromosomes as bearers of hereditary characters. It is remarkable, in this connection, that although elimination of the paternal and maternal X-chromosome is equally common, evidence for the elimination of other chromosomes, which would give mosaics in characters unconnected with sex, is very rarely obtained.

Analysis of the records of gynandromorphs in other groups of animals shows that most are susceptible of the same explanation. In a few cases some other hypothesis, such as that of a binucleate egg, must be invoked. It should be noted that in part i. there

[1] Contributions to the Genetics of *Drosophila melanogaster*. I. "The Origin of Gynandromorphs." By T. H. Morgan and C. B. Bridges. II. "The Second Chromosome Group of Mutant Characters." By C. B. Bridges and T. H. Morgan. III. "Inherited Linkage Variations in the Second Chromosome." By A. H. Sturtevant. IV. "A Demonstration of Genes Modifying the Character 'Notch.'" By T. H. Morgan. Pp. v+388+12 plates. Publication No. 278. (Washington: Carnegie Institution of Washington, 1919.)

are several slips and misprints; on plate ii., Figs. 4 and 5 are transposed, according to the description; on p. 28 the word "visible" appears to be a misprint for "recessive"; and on p. 86, l. 26, "female" is printed for "male," etc. But apart from these slips and the rather inconvenient arrangement of the subject-matter, the work is the most valuable on the subject of gynandromorphism with which we are acquainted.

Space does not allow of more than a brief reference to the other three parts. Part ii. discusses in detail all the mutant characters that have occurred in "the second chromosome," *i.e.* those characters belonging to the second linked group which are not sex-limited (sex-linked) in inheritance. Full data of crossing-over ratios are given, and on the basis of these a map of the chromosome is constructed, like those previously published for the X-chromosome. Part iii. deals with inherited linkage variations in the same group, and it is concluded that two factors, the position of which in the series is determinable by their linkage relations, reduce the amount of crossing-over between certain factors without altering their sequence in the series. Part iv. describes the isolation by selection of a factor which affects the extent of development of the character "notch" in the wing, and proves that change resulting from selection is due, not to an alteration in the factor for "notch," but to the presence of a distinct modifying factor. It is also shown that Castle's hypothesis of contamination by heterozygosis is untenable.

Finally, it is impossible to read the facts presented in this volume without being impressed by the great strength of the evidence for Morgan's theory that Mendelian factors are borne by chromosomes and arranged in definite sequence within them. Difficulties remain, but a theory which enables predictions to be made and verified cannot lightly be disregarded.

L. DONCASTER.

The Conservation of Fuel.

IN view of the importance of national economy in our fuel reserves, it is not surprising to find that Sir Dugald Clerk selected the subject of the conservation of fuel in the United Kingdom for the James Forrest lecture which he delivered at the Institution of Civil Engineers on April 20. The coal raised in 1913 was about 287·4 million tons, of which 189 million tons were retained and consumed here. The total coal reserves at 2 per cent. per annum increase will be exhausted in about 250 years, but fuel will be so expensive long before that time has elapsed that we shall be hard pressed to maintain the existing population. A return to the agricultural civilisation of 1750 would require the reduction of our population to one-third. It is of the utmost importance to study the engineering problems arising.

A great part of the lecture was taken up in criticising the figures given by the Coal Conservation Committee. It will be remembered that this Committee advocated the establishment of large turbo-electric stations at about sixteen centres, and the covering of the country with a network of mains capable of supplying our whole power needs by electric motors. By this scheme the Committee expected to save 55 million tons of coal on power alone. Many competent electricians and capable motive-power engineers have the gravest doubts as to the accuracy of the data presented, and as to the outcome of the ambitious scheme advocated. The Committee adopted the figure of 5 lb. of coal per horse-power-hour as the present consumption; Sir Dugald gave estimations arrived at by two different methods: one of 3·9 lb. per b.h.p.-hour and another of 4·05 lb. per b.h.p.-hour. The first value is based on a census of production data corrected by allowing for steam production other than for motive power, and for an error in total h.p.-hours as determined by the Committee. The second value of 4·05 lb. is estimated by considering the average of many typical steam engines. Taking the whole of the facts into consideration, and assuming electricity in the future to be used for the generation of power and light only, then a reduction to 1·56 lb. of coal per b.h.p.-hour would give a possible saving of not more than 37½ million tons of coal per annum. The saving of 55 million tons expected by the Committee is, in Sir Dugald Clerk's opinion, based on fallacious reasoning.

The Committee in its report clearly intends also to generate heat, and expects to do so with economy superior to the existing systems of coal and gas combustion. Sir Dugald went into the question of the comparison of gas with electricity for domestic heating, and arrived at the figure of 43·6 per cent. of the heat used at the gasworks as the proportion which the consumer receives at his premises; taking the efficiency of the gas at 42 per cent., the final efficiency, referred to the heat consumption at the gasworks, is $43{\cdot}6\times0{\cdot}42=18{\cdot}3$ per cent. In electric heating the consumer receives 11·7 per cent. of the heat consumed in the thermodynamic transformation at the super-station, and using this with an efficiency of 59 per cent., the consumer obtains in his apparatus $11{\cdot}7\times0{\cdot}59=6{\cdot}9$ per cent. of the heat units consumed at the generating station. Assuming the gasworks to be abolished, and electric generating stations to be expanded so as to supply current for heat supply at the same generating efficiency as for power, and taking all facts into consideration, Sir Dugald estimates that the whole assumed saving on power will be lost, and that 68·6 million tons of coal per annum will be consumed instead of 67·5; he therefore considers that the super-stations will not justify their existence, that the Government scheme is wrong, and that the sweeping conclusions arrived at by the Coal Conservation Committee are unjustifiable.

Sir Dugald gives some methods of saving fuel which are immediately applicable. Great changes are now in operation throughout the gas industry due to the adoption of the thermal unit standard for sale. In a few years the majority of gasworks will deliver to the consumer in the form of gas 75 per cent. of the whole heat of the coal, and the improvements in gas apparatus, etc., are so great that the efficiency of use of the gas will rise from 42 to 55 per cent. He estimates that a saving of 4·8 million tons of coal on the present consumption will result from these changes. On the assumption of the complete displacement of coal in households by gas, we should use only 17·5 million tons instead of 35 millions.

Mr. D. Brownlie's figures for coal consumed in boiler furnaces were quoted. If boiler attendants be better trained, and masters take some pride in obtaining best efficiencies, a saving of 4 million tons per annum would result. Collieries consume about 17 million tons per annum in boiler furnaces at an average efficiency of 55·5 per cent. If this be raised to 75 per cent., the saving on this item would be 4·4 million tons per annum.

The notion of the great gain to be expected from very large steam turbines is held to be quite erroneous. Even with the most modern plant an increase in power per turbine from 10,000 to 100,000 kilowatts only reduces the steam consumption from 9 to 8·5 lb. per kilowatt-hour. A recent examination by Sir

Dugald of the limits of thermal efficiency of gas and oil engines shows that 45 per cent. b.h.p. may be obtained in the near future. Sir Charles Parsons at the same time prepared an estimate of the limiting efficiency of the steam turbine as 28 per cent. Steam, internal-combusion, and gas engineers welcome the free competition with electricity supply, but consider that any attempt to crush out the smaller power units by a great Government scheme will act against the best interests of the country as to both coal conservation and economy in cost.

Sir Dugald also referred to the principle of heating towns by utilising the exhaust steam from steam turbines in central stations, and to Lord Kelvin's proposal to heat rooms by means of reversed Carnot cycle engines. By making full use of our water-power, three million horse-power could be added to the work of the country without consuming any additional coal

Buddhism in the Pacific.

AT a meeting of the Royal Anthropological Institute on Tuesday, May 18, Sir Everard im Thurn, president, in the chair, Sir Henry Howorth read a paper on "Buddhism in the Pacific." The paper discussed the disintegrated distribution of the Polynesian race, and the occurrence, especially in the Hawaian archipelago and that of New Zealand, of two of its factors which are separated by the whole length of the Pacific Ocean, one occurring in the extreme north and the other in the extreme south, and separated by an intervening area occupied largely by Melanesians. The two factors in question agree very closely in language, while they differ materially in the art and form of the objects which they use. Inasmuch as the Maoris almost certainly migrated to their present quarters at the beginning of the fifteenth century, this is the only way to account for the virtual identity of their speech with that of the Hawaians, and the general character of their ornamental work with that of the Melanesians. The Hawaians, on the other hand, present us with a series of objects, *i.e.* helmets and cloaks, made of feathers which, in their form and colour, differ entirely from those made by other members of the Polynesian race. They agree in an extraordinary way in colour and form with those of the Reformed Lamaists of Tibet, who, like other Buddhists, were great travellers and evangelists at a time when Chinese and Japanese vessels, as has been so completely proved in recent years, were traversing the Indian Ocean and visiting the whole of the eastern archipelago at least as far as New Guinea, and apparently even reaching New Zealand, where many years ago a very interesting bronze figure was found.

Sir Henry Howorth quoted instances of the drifting and wreckage of Chinese and Japanese vessels on the central and eastern Pacific during the time which has elapsed since Europeans first visited that ocean, and also the tradition of the Sandwich Islanders that several Japanese and Chinese ships had been wrecked among them in early times. It was not wonderful, therefore, that we should find their kings and gods adopting the stately dress used by the Lamas, the colours of which they imitated in feathers. All the details of the helmets exactly equate, while the cloaks are ornamented with patches of red on yellow or yellow on red, just as the Lamaist cloaks are, in the latter case in pursuance of the injunction of their founder that their cloaks must be ragged and patched.

In the interesting discussion which followed the reading of the paper, Dr. Glanvill Corney cited examples, some of which had come under his own observation, of the drifting of boats with native crews for long distances in the Pacific, and pointed out that the Polynesians were always ready to put out to sea. The Chinese had it on record that Buddhists visited Mexico at a very early date. The similarity shown by the helmets and cloaks of Hawaii and Tibet was very striking, and the explanation offered by Sir Henry Howorth was most probable.

Mr. Ray said that he himself for some years had been of the opinion that certain elements had been carried into Polynesia at least from Malaya, if not from farther—possibly Japan. The characteristic of the Polynesian was that he was very prone to imitate anything which took his fancy, as, for instance, European hats had been imitated. The Cambridge Expedition to the Torres Straits had found a club which was clearly an imitation of a Loyalty Islands club.

Mr. Hocart said that in dealing with the wanderings of the Polynesians too much stress had been laid on drifting, but deliberate purpose should be more emphasised. There was among the Polynesians a distinct passion for finding out new lands.

Dr. Forbes adduced as evidence of early movement Chinese objects which he had seen taken from Peruvian graves which were certainly pre-Inca in date.

Sir Everard im Thurn, in bringing the discussion to a close, said that Buddhist monks might well have accompanied the early voyagers in the Pacific. His attention had recently been directed to the question of the Hawaian helmets, and he wished to point out that the native peoples of the Pacific were very fond of making head-coverings for use on ceremonial occasions. They paid great attention to the ornamental dressing of their hair, and if their hair were not suitable for this purpose they made artificial hair out of grass seed. He himself had brought back from Fiji an example of a native wig used in a ceremonial dance, which was now in the Pitt Rivers Museum at Oxford. It was probable, therefore, in view of this particular tendency, that the Hawaians would take readily to copying the head-dress of the Buddhists. This particular form of head-dress or helmet was not confined to Hawaii; objects ornamented with men's heads wearing head-dresses like those of Hawaii occurred in Hermit Island, near New Ireland.

Astronomy at Oxford during the War.

WE have recently received from Prof. H. H. Turner, of the Oxford University Observatory, a collection of papers published during the years 1914–19. These for the most part are reprints from the Monthly Notices of the Royal Astronomical Society, and represent researches carried out during this period by Prof. Turner and various members of his staff, including several volunteer workers who have rendered some valuable assistance. It is, of course, impossible adequately to discuss a miscellaneous collection of papers such as this in any detail, but there are several outstanding features of interest which call for special remark.

In the first place, a considerable number of the papers is devoted to an important research of Prof. Turner's on "A Proposal for the Comparison of the Stellar Magnitude Scales of the Different Observatories taking Part in the Astrographic Catalogue." This was first outlined at Paris in 1909, the proposal being: "That the number of images recorded under each unit of the magnitude scale be counted and tabulated." The chief objects in view were to detect systematic errors of scale at the various collaborating observatories, and to test Prof. Kapteyn's conclusion that the Galaxy is relatively richer in faint

stars than the remaining parts of the sky—a theory upon which some doubt had been cast by earlier work of this nature. The method, although of extreme simplicity, has certainly proved efficient for the first of these objects, and various systematic errors of scale have been clearly exhibited. With regard to the second object, an examination of the ratio of the number of faint stars to bright in the various regions investigated appeared at first to negative Prof. Kapteyn's conclusion; but, although this ratio was not found to vary with galactic latitude, certain changes were detected in different parts of the sky. Prof. Turner has thus been led to the interesting conclusion that regions of "obscuration" exist which tend to obliterate the fainter stars, and these regions appear to form a spiral in the heavens, the central line of which is approximately given by the equation

$$\alpha + 3{\cdot}66\delta = 247^\circ,$$

where α denotes right ascension and δ declination. There appears to be a fairly sharp boundary to this "spiral of obscuration" on the side of smaller R.A. in the northern hemisphere, and on the side of greater R.A. in the southern hemisphere.

Another very valuable piece of work is represented by a series of papers on "Baxendell's Observations of Variable Stars," edited by Prof. Turner and Miss M. A. Blagg. A very considerable amount of painstaking work must have been expended on this task of revising and editing Baxendell's observations of some twenty-three long-period variables. The greater part of the work appears to have been done by Miss Blagg, and the result as a whole is certainly a most valuable contribution to the study of this particular branch of astronomy. In connection with this subject we may also mention two papers by Prof. Turner "On the Classification of Long-period Variables," in which the alternative classifications of the author and of the Rev. T. E. R. Phillips are discussed and compared at some length. Both methods are considered to be useful, and a suggestion is made that some stars might pass from one of Phillips's groups to the other during the course of their evolution. This latter idea is more fully discussed in the particular case of W Cygni, which appears to be changing from Phillips's Group 1. to Group II.

There are many other shorter papers of considerable interest, but these are too numerous to be noted here individually. The whole collection pays ample tribute to the energy and resource with which work has been carried out at the observatory during the trying period of the last few years. Apart from the many difficulties directly resulting from the war, there have been other troubles with which the staff has had to contend. In particular, we regret to note the decease of the caretaker, Mr. J. Mullis, who had been with the observatory since its erection in 1874. There is at present no second assistant or resident computer, and Prof. Turner and his staff must certainly be congratulated on the way in which the work has been carried on in the face of these and numerous other difficulties. D. L. E.

The Alligator Pear.

THE cultivation of the Avocado or alligator pear is the subject of articles by Mr. W. G. Freeman and others in the Bulletin of the Department of Agriculture, Trinidad and Tobago (vol. xviii., part 3). The Avocado (*Persea gratissima*), a member of the family Lauraceæ, is a pear-shaped fruit with a large central stone, the amount of covering flesh varying considerably according as the kind is good or poor. It is one of the most important of the fruits which have become widely distributed since the discovery of the New World. It is probably a native of tropical America, and was introduced at an early date into the West Indies, where it is now naturalised. Sir Hans Sloane, in his "History of Jamaica" (1707–25), gives a long description of the tree and its fruit, and Dr. Patrick Browne (1756) is eloquent on the flavour of the latter and the esteem in which it is held. The edible portion of the fruit varies from a little under one-half to more than three-quarters of the weight of the whole, according to the thickness of the rind and the relative size of the seed. Its food-value is mainly due to its high fat content, which in some varieties approaches that of the olive, and is especially high in the fruit grown in Florida and California.

Although so long cultivated in the West Indies, yet little attention has been given until recently to the selection and propagation of good varieties. It is an extremely variable plant, and the method of selecting seeds from trees bearing the best fruit and of high productiveness gives uncertain results, as the varieties do not come true from seed. But by budding or grafting from good varieties these may be fixed, and by this means poor trees will be converted into good varieties. Mr. Freeman suggests the probability of a seedless Avocado being obtained, as occasional seedless fruits have been reported from the United States and Honolulu. The Avocado needs no very special care in cultivation, and does very well on the poor soil of parts of the northern range in Trinidad. Budding has been practised at the St. Clair Experiment Station for the last four years, and the curator, Mr. R. O. Williams, gives details of the operation. The method is the same as that generally adopted for roses and citrus. The full-grown tree is fairly free from insect pests, but the plant is more susceptible in early stages and when recently budded. Mr. F. W. Urich describes the various insect pests and means for combating them. A more serious disease which attacks the fruit is the so-called anthracnose, very closely related to the fungus which causes anthracnose of the mango. In the case of fruits packed for export this disease causes complete rotting of the whole consignment. Repeated sprayings with Bordeaux mixture are necessary to prevent its development.

The Improvement of Grassland.[1]

IT is too often the case that grassland is left to take care of itself, and that no steps are taken for its improvement. Even where manuring is carried out it is usually confined to occasional dressings of farmyard manure; little or no use is made of artificial fertilisers, and the beneficial effects of lime upon the herbage are far less widely known than they should be. The consequence is that much of the finest pasture and meadow land in the country is carrying only a second- or third-rate herbage simply from lack of knowledge of the most effective treatments to bring about improvement. For the education of public opinion in this respect nothing is more useful than demonstration plots, and the Ministry of Agriculture and Fisheries has issued a most valuable and comprehensive pamphlet outlining schemes of experiments suitable for this purpose. The schemes intended for farmers are simple in character and direct and practical in their object, while those drawn up for the agricultural colleges and institutes deal with experiments requiring considerable attention and supervision.

[1] "The Improvement of Grassland: Suggestions for Demonstrations and Experiments." Miscellaneous Publications No. 25. Ministry of Agriculture and Fisheries.

As a preliminary, the necessary tables are given to enable the manures used to be standardised to ensure uniformity of treatment so far as possible, and the method of noting and reporting the results is clearly outlined. It is recommended that the attention of farmers should be devoted to the improvement of the various classes of grassland on different types of soil, and particulars are given for the manuring of meadow hay, "seeds" or rotation hay, and pastures of different grades. Emphasis is laid on the value of liming experiments, which should be carried on at the same time as the manurial tests.

The attention of agricultural colleges and institutes is directed to the need for various experiments other than manurial trials. Grazing trials properly carried out would provide valuable information as to the best methods of dealing with pasture land, and mechanical operations are suggested to show the effect of mole-draining, cultivation, breaking, and reseeding. In addition, it is suggested that a good deal of attention might profitably be directed to a consideration of the seeds used for sowing down, with regard to the permanence of different varieties, the most suitable mixtures for leys and for renovating permanent grass, and to the possibility of harvesting supplies of seed.

The pamphlet is so suggestive and so broad in its scope that it should find its way into the hands of all interested in grassland, and it is much to be hoped that the official nature of the publication will not prevent it from reaching the general farming public.

W. E. BRENCHLEY.

Levelling Errors.[1]

A DEPARTMENTAL paper lately published by the Survey of Egypt contains an interesting investigation of a systematic error which has been found to occur in the levelling carried out in Egypt and in the Sudan. The effect of this error, which has the same sign over all kinds of ground, acts in the direction of making the backstaff reading systematically too small and the forestaff reading too great. Movement of the staves or level and other sources of error having been eliminated, the author draws the conclusion that the effect of refraction is not wholly removed by keeping the distances between the level and the staves equal in the conditions under which the work is done. Precise levelling in Egypt is carried out in the winter months and during about three hours after sunrise and three hours before sunset. Experiments have shown that at sunrise a temperature lapse-rate of the order of 1° C. to 2° C. per metre often exists, the air being colder near the ground than higher up. In two or three hours this lapse-rate has disappeared, and a little later becomes reversed, so that with hotter air near the ground setting up convection currents, unsteadiness of the staff-image sets in, preventing further work. In the afternoon the ground cools very slowly, so that the change in the temperature lapse-rate, and consequently in the refraction, is then very gradual.

The error is, therefore, traced to the very rapid change in refraction during the early morning hours, of which the effect is noticeable in observations taken at a few minutes' interval. To eliminate it, all staff readings are now taken with as little delay as possible, and the observer reads alternately the backstaff first and the forestaff first—a procedure which has very materially reduced the systematic error, not only in precise levelling, but to a much greater degree in second-order levelling, where the time taken between successive readings is much longer.

1 "Systematic Error in Spirit Levelling." By J. H. Cole. Survey of Egypt Departmental Paper No. 35. (Cairo, 1919.)

It has been recognised for some time that a systematic error may be caused by such a temperature inversion when levelling over sloping ground, but in the present report the rapid change of the temperature lapse-rate from a maximum value to zero is indicated as a cause which may be expected to operate even on level ground in any region where hot days follow clear, cold nights with effective radiation. In the last annual report of the Ordnance Survey such a systematic error, almost invariably of one sign, is referred to as being still unexplained. It would seem that here also local temperature inversions near the ground may be concerned to some extent.

H. G. L.

University and Educational Intelligence.

BIRMINGHAM.—Sir John Cadman is resigning his post as professor of mining at the end of the current session.

CAMBRIDGE.—On May 19 the degree of Doctor of Law *honoris causa* was conferred upon Lord Plymouth, Admiral of the Fleet Lord Jellicoe, Field-Marshal Lord Haig, Rear-Admiral Sir W. R. Hall, M.P., the Abbé Henri Breuil, Institute of Human Paiæontology, Paris, and Sir John Sandys, Orator Emeritus.

LEEDS.—At a meeting of the University Council held on May 19, it was resolved that a chair of physical chemistry should be instituted, and Dr. H. M. Dawson was selected to be the first occupant of the chair. Since 1905 Dr. Dawson has been lecturer in physical chemistry at the University, and has carried out extensive researches in various branches of physical chemistry—in particular, investigations bearing on the constitution of solutions and on the mechanism of chemical change.

LONDON.—The degree of D.Sc. (Engineering) has been conferred on Mr. B. C. Laws, an external student, for a thesis entitled "Elasticity and Distribution of Stress in Thin Steel Plates," and other papers.

From the report of the Principal Officer (Sir Cooper Perry) for 1919–20, it appears that the University can look forward to a period of unprecedented development. Admissions by all channels in 1919–20 amounted to 12,608, almost double the corresponding number for 1913–14. Candidates for first degrees were 936, comparing with 1636, reflecting the diminished numbers of those who matriculated "during the lean—the honourably lean—years of the war." It is of interest to note that of the 1086 candidates for all degrees, 613 were internal and 473 external. This is gratifying evidence that the "private" student is tending to disappear, or, rather, to study under more favourable conditions. The list of benefactions to the University and its colleges is most encouraging. The outstanding gift is from the trustees of the Sir Ernest Cassel Educational Trust of 150,000*l*., and 4000*l*. a year for five years. New University chairs have been established in aeronautics, modern Greek, Portuguese, Imperial history, Dutch, bacteriology, physiology, pathology, and physics. The question of hostel accommodation is being considered by a special committee. The report concludes on "a justified note of congratulation." The duty of the universities is plain; their province, though extensive and varied, is defined; their way is illuminated; "into the universities the nation looks in a unique degree for hearts and minds fitted to enrich the blood of the race—for the constant supply of men and women of trained insight and enlarged sympathies, apt for the higher offices of citizenship. This is our peculiar duty—to

conduct the Lampadephoria of the inspiration of humanity, and to guard and develop the most precious and enduring aspects of the most comprehensive of all the arts—the art of Life itself."

THE new building of the Department of Applied Statistics and Eugenics (including the Galton and Biometric Laboratories) at University College, London, will be opened by Dr. Addison, Minister of Health, on Friday, June 4. The Vice-Chancellor of the University will preside.

TWO lectures on Factors in the Froth-flotation of Minerals will be given at the Sir John Cass Technical Institute, Aldgate, E.C. 3, by Mr. H. Livingstone Sulman, on Wednesdays, June 2 and 9, at 5.30 p.m. The chair at the opening lecture will be taken by Mr. F. Merricks, president of the Institution of Mining and Metallurgy.

THE Glasgow Technical College is preparing for its entrance hall a monument in bronze and marble to the 612 students and members of its staff who gave their lives in the war. To show the quality and quantity of the war work of the 3218 members, students, and past students of the college who served in the Army or Navy, or on special national duty, the college has issued, in a volume of 211 pages, a list of their names and services. The preface, by Sir George Beilby and Mr. Stockdale, the director, summarises the contributions of the college to research on fuels and explosives, the testing of war materials, and the training of munition workers. The normal classes had to be maintained for the thousands of evening students as well as for the many foreigners and refugees, for whom most of the day classes had to be continued in spite of the reduction in the staff. The successes enumerated include three awards of the Victoria Cross and 336 orders and crosses. Amongst the ranks attained, one student became colonel, fifteen were lieutenant-colonels, and seventy-seven majors. The letters quoted from the Government Departments express high appreciation of the research work conducted at the college. Of its contributions, both of men and mind, to the national strength, the college and science may well be proud.

THE recently issued report on the war work of the College of Technology, Manchester (faculty of technology in Manchester University), gives an interesting account of the services rendered by members of the college in his Majesty's Forces—particularly in connection with the Royal Engineers and the technical branches of the Royal Navy—and in the many fields of scientific research opened up by the war. The greater part of the report is concerned with college war work other than that of supplying men. It appears that before the war was over the college was by no means large enough to undertake all the work which the military authorities—including the Air Board as well as the Admiralty and the War Office—were anxious to entrust to it. The mechanical and electrical engineering departments of the college were intimately concerned with the work of the Lancashire Anti-Submarine Committee, which had its headquarters in the college, and produced and developed several instruments, including, in particular, a deep-sea hydrophone for detecting and combating enemy submarines. The same departments helped to solve certain problems relating to the fitting of wireless apparatus to aeroplanes; for instance, a high frequency alternator, designed and manufactured in the college, was largely adopted for both naval and military 'planes. A new type of gas furnace designed in the college led to important improvements in the heat treatment of machine tools, involving an increase of 30 per cent. in the speed of the machining of shells and other munitions. The same research enabled the college to supply the Admiralty with special blades for cutting mine mooring cables, and when the demand for these blades was greater than the college could supply, the Admiralty required its manufacturers to employ the method of heat treatment devised in the College of Technology. An improved cast iron of high tensile strength, produced under the direction of the metallurgical department of the college, was usefully employed in the manufacture of gas shells. The college departments of applied chemistry and textiles carried out a number of investigations upon fabrics used in aircraft manufacture. A thorough investigation of the structure and scouring of airship fabrics led to the development of a process which was afterwards applied to all R.N.A.S. fabrics. The giant airships R_{33} and R_{34} were treated with a special dope produced at the college before starting on their long-distance flights. The chemical laboratories were also engaged during the war in investigating processes for the manufacture of explosives, pharmaceutical products, dyestuffs, rubber derivatives, and foodstuffs.

Societies and Academies.

LONDON.

Royal Society, May 13.—Sir J. J. Thomson, president, in the chair.—Dr. A. D. **Waller**: Demonstration of the apparent "growth" of plants (and of inanimate materials) and of their apparent "contractility." In Sir J. C. Bose's original demonstration an amputated leaf was fixed up in connection with a crescograph, at a magnification stated to be $\times 10^7$, and the indicator was shown to be moving in a direction and at a speed that were stated as representing the growth of the petiole. Alternating currents were now sent through the leaf, causing a sudden reversal of the movement of the indicator, *e.g.* in the demonstration that the present author witnessed at the Royal Society of Medicine the indicator (a spot of reflected light) moved to the right at what he judged to be something like 1 metre per sec. in the direction of elongation (by growth?), and flew off scale in the opposite direction, at least ten times as fast, as soon as the buzz of the exciting coil was heard ("degrowth"). The demonstration was, in Dr. Waller's opinion, illusory. The movement to the right (indicating an elongation of petiole=0·1 m. per sec.) was indeed consistent with "growth," although its rate was surprisingly high under the conditions of experiment. The elongation might, however, have been due to, or modified by, many accidental variations of conditions—heat, moisture, handling of plant during preparation, etc.—and was precisely similar to the gradual elongation that takes place in a damp fiddle-string under similar conditions. The second part of the experiment, when the "excited" plant shortened and caused the indicator to fly off to the left, is held to afford conclusive proof of fallacy. The fact belonged to the familiar phenomena of heat contraction aroused by electrical currents in all kinds of (doubly refracting) moist conductors, whether living or dead, to the study of which attention was directed by Engelmann in his Croonian Lecture of 1895. These are demonstrable with a low-power crescograph ($\times 10^2$), and play a part in masking or simulating physiological changes when a high power ($\times 10^7$) is employed.—W. N. F. **Woodland**: The "renal portal" system (renal venous meshwork) and kidney excretion in vertebrata. The first three parts of this memoir contain, in the first place, proof that the assumption, commonly made in physiological literature, that the venous blood "supplied" to the kidneys of lower vertebrata mixes with

the arterial blood and traverses the system of channels known in mammals as the intertubular plexus, is erroneous—the renal afferent vein-blood does not supply the kidney tubules. The renal artery-blood traverses the intertubular plexus proper, and the renal afferent vein-blood a system of wide sinusoids (renal venous meshwork), which has no connection with the intertubular plexus, save that the latter opens into the former where the venous blood flows into the renal efferent veins. In the second place, much experimental and otherevidence is provided to prove that the "renal portal" system is devoid of function so far as kidney secretion is concerned. Evidence is also adduced to shew that the urine is solely secreted by the renal tubules, the glomeruli taking no part. The glomeruli (as will be explained in the forthcoming Part iv.) are solely to be regarded as retia mirabilia and function as such. This is the tubule-cum-rete theory of kidney secretion.

Zoological Society, May 11.—Prof. J. P. Hill, vice-president, in the chair.—Dr. W. J. **Dakin**: Fauna of Western Australia. III. Further contributions to the study of the Onychophora.—C. **Forster-Cooper**: Chalicotheroidea from Baluchistan.

PARIS.

Academy of Sciences, May 3.—M. Henri Deslandres in the chair.—C. **Moureu** and J. C. **Bongrand**: New researches on carbon sub-nitride. The action of the halogens, haloid acids, and alcohols. Numerous attempts to prepare the compound CN—C≡C—CN in quantity proved unsuccessful, and hence experiments on this substance had to be confined to those requiring little material. The sub-nitride combines with bromine. Hydrobromic acid gives bromobutene dinitrile, CN—CH=CBr—CN, and hydriodic acid furnishes the corresponding iodine compound. Hydrochloric acid acts differently, addition and partial hydrolysis taking place simultaneously, giving chlorobutene nitrile amide,

$$CN—CH=CCl—CONH_2.$$

Ethyl alcohol forms an addition product, probably ethoxybutene-dinitrile.—J. **Constantin**: The fossil chalk Siphoneæ of Munier-Chalmas.—A. **Blondel**: Best conditions to be fulfilled by long-distance electric cables for energy transmission. Practical solutions.—A. de **Gramont**: The spectrographic detection of metals, especially zinc, in animal organisms. Details of the application of the spectrograph to the detection of zinc in the ash from snake poison.—G. **Julia**: Families of functions of several variables.—B. **Jekhowsky**: Differential equations of the second order verified by Bessel's functions of several variables.—J. Kampé de **Fériet**: The use of generalised differentials for the formation and integration of certain linear differential equations.—MM. **Descolas** and **Prétet**: The macrographic study of the propagation of cooling in the interior of a steel ingot starting from its solidification. The method is based on the appearance of the specimen after etching with dilute sulphuric acid (17 in 5).—D. **Hondros**: The integration of the Laplace equation between two non-concentric spheres.—M. de **Broglie**: The properties of reinforcing screens with respect to X-ray spectra and on a splitting of the β line of the K spectrum of tungsten.—G. **Chaudron**: Reversible reactions of water on tungsten and the oxides of tungsten. The constant $K=\frac{p(H_2O)}{pH_2}$ has been studied at temperatures between 600° C. and 1000° C. The results are given in both numerical and graphical forms.—C. **Zenghelis** and B. **Papaconstantinou**: Colloidal rhodium. Sodium rhodiochloride was reduced in presence of sodium protalbinate by various reducing agents, hydrazine sulphate, hydrogen gas, and formaldehyde, the last of which gave the best preparation. After dialysis and drying in a vacuum, brilliant scales are obtained which are very stable. Solutions have remained unchanged for two years. The crystals contain 33 per cent. of rhodium. Colloidal rhodium absorbs about 2700 times its volume of hydrogen, and from 300 to 1800 times its volume of carbon monoxide, according to the conditions.—O. **Bailly**: The action of neutral methyl and ethyl sulphates on alkaline phosphates in aqueous solution.—J. B. **Senderens** and J. **Aboulenc**: The catalytic decomposition of the fatty acids by carbon. The vapours of the fatty acids, from acetic to isovaleric, give no gas at 460° C. in the absence of a catalyst; but in presence of purified animal charcoal decomposition takes place at 360° to 380° C. The products of the reaction include carbon monoxide and dioxide, unsaturated hydrocarbons, hydrogen and methane, a liquid containing water, and traces of ketones and aldehydes. Sugar carbon is less active as a catalyst, and a much higher temperature is required to effect the decomposition.—P. **Guérin** and A. **Goris**: A new plant containing coumarin, *Melettis melissophyllum*. The presence of coumarin in this labiate has been proved: it probably occurs as a glucoside hydrolysable by emulsin.—Ad. Davy de **Virville**: Note on the comparative geographical distribution of *Primula officinalis*, *P. grandiflora*, and *P. elatior* in the west of France. *P. grandiflora* grows best in damp, shady spots, whilst *P. officinalis* prefers dry soil and positions exposed to sun; hence, although hybrids of these two species are readily formed, they rarely occur in Nature. In railway cuttings the conditions favourable to each species may occur in close proximity, and hence the hybrid is particularly abundant along railway lines. It is suggested that *P. elatior* may have originated as a hybrid between the two species above-mentioned.—H. **Coupin**: Seedlings which turn green in the dark. The green colouring matter of pine seedlings grown in the absence of light is not identical with that of pine seedlings grown in daylight. The differences are marked in *Pinus sylvestris*, less marked in *P. pinea*, and slight in *P. maritima*.—A. **Mayer**: The mode of action of the poison gases utilised during the war.—I. **Nageotte**: Formation and structure of blood-clots.—H. **Violle**: Milk and hæmolysis. Normal milk does not produce hæmolysis of red blood corpuscles, not even when mixed with 30 per cent. of its volume of water. Any milk producing hæmolysis after this addition of water is abnormal.—M. **Marage**: The limits of debility and pretuberculosis.—P. **Wintrebert**: Medullary conduction in *Scyllorhinus canicula*, and the supposed function of the transitory dorsal giant cells of Rohon-Beard.—M. **Lécaillon**: Eggs intermediate between the summer and winter eggs produced in the cocoon of the silkworm.—L. **Hudelo**, A. **Sartory**, and H. **Montlour**: Eczematoid epidemiomycosis due to a parasite of the genus Endomyces.—F. **Diénert**, F. **Wandenbulke**, and Mlle. M. **Launey**: The action of activated sludges.

Books Received.

The Social Diseases: Tuberculosis, Syphilis, Alcoholism, Sterility. By Dr. J. Héricourt. Translated, with a final chapter, by B. Miall. Pp. x+246. (London: George Routledge and Sons, Ltd.) 7s. 6d. net.

Animal and Vegetable Oils, Fats, and Waxes: Their Manufacture, Refining, and Analysis, including the Manufacture of Candles, Margarine, and Butter. By Dr. G. Martin. Pp. x+218. (London: Crosby Lockwood and Son.) 12s. 6d. net.

Department of Statistics, India. Agricultural Statistics of India, 1917–18. Vol. i. Pp. xvi+321. (Calcutta: Superintendent, Government Printing, India.) 2 rupees.

Geology of the Mid-Continent Oilfields, Kansas, Oklahoma, and North Texas. By Dr. T. O. Bosworth. Pp. xv+314. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 3 dollars.

Chemical Services Committee, 1920, Report. Pp. xii+121. (Simla: Supt., Government Central Press.)

Diary of Societies.

THURSDAY, MAY 27.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—William Archer: Dreams, with Special Reference to Psycho-Analysis.

LINNEAN SOCIETY (Anniversary Meeting), at 3.

ROYAL SOCIETY, at 4.30.

CONCRETE INSTITUTE (Annual General Meeting, followed by an Ordinary Meeting), at 7.30.—Major H. Best: The Mystery Port, Richborough.

ROYAL SOCIETY OF MEDICINE (Urology Section), at 8.30.—Sir Peter Freyer: Modern Progress in Urinary Surgery.

FRIDAY, MAY 28.

ROYAL SOCIETY OF MEDICINE (Study of Disease in Children Section) at 4.30.—(Annual General Meeting.)

PHYSICAL SOCIETY OF LONDON, at 5.—Sir W. H. Bragg and Others: Discussion on X-ray Spectra.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—A. Arnold: Two Years as an Engineer in the Grand Fleet.

ROYAL SOCIETY OF MEDICINE (Epidemiology and State Medicine Section) (Annual General Meeting), at 8.30.—Dr. P. Hartley and Prof. C. J. Martin: The Apparent Rate of Disappearence of Diphtheria Bacilli from the Throat after an Attack of the Disease.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. W. L. Bragg: The Packing of Atoms in Crystals.

SATURDAY, MAY 29.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. J. H. Jeans: The Theory of Relativity (Tyndall Lectures).

MONDAY, MAY 31.

ROYAL SOCIETY OF ARTS (Indian Section), at 4.30.—A. Howard: The Improvement of Crop Production in India.

VICTORIA INSTITUTE (at Central Buildings, Westminster), at 4.30.—Rev. S. A. McDowall: The Meaning of the Æsthetic Impulse.

SURVEYORS' INSTITUTION, at 5.—(Annual General Meeting.)

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 5.30.—(Anniversary Meeting.)

ROYAL SOCIETY OF MEDICINE (Odontology Section) (Annual General Meeting), at 8.—C. A. Clark: Relation of Teeth to the Floor of the Antrum.

TUESDAY, JUNE 1.

INSTITUTION OF GAS ENGINEERS (at Institution of Mechanical Engineers), at 10.30 a.m.—Sir Dugald Clerk: Presidential Address.—Report of Refractory Materials Research Committee: (*a*) The Casting of Gas Retorts; (*b*) Some Comparative Tests of Machine-made and Hand-made Silica Bricks; (*c*) The Specific Heats of Refractory Materials at High Temperatures.—Report of the Life of Gas Meters Research Committee: The Internal Corrosion of Mains, Services, and Meters.—Dr. S. F. Dufton and Prof. J. W. Cobb: Report of Institution Gas Research Fellowship: Some High Temperature Reactions of Toluene and Benzene.

ROYAL HORTICULTURAL SOCIETY (at Royal Gardens, Chelsea), at 3.—Dr. E. J. Russell: Some Modern Aspects of Manuring.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Major C. E. Inglis: The Evolution of Large Bridge Construction.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. G. M. Vevers: Report on the Entozoa Collected from Animals which Died in the Gardens during the Past Nine Months.—Prof. R. T. Leiper: Exhibition: Experimental Transmission of Some Helminth Infections.—Dr. W. T. Calman: Notes on Marine Wood-boring Animals, 1. The Shipworms (Teredinidæ).—Dr. P. Chalmers Mitchell: Notes on an African Trip, with Lantern Illustrations.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Technical Meeting), at 7.—C. P. Crowther: Japanese *Mélange*, including Photographs and Examples of Japanese Crafts.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Dr. B. Malinowski: The Economic Pursuits of the Trobriand Islands.

RÖNTGEN SOCIETY (at Medical Society of London), at 8.15.—(Annual General Meeting.)

ROYAL SOCIETY OF MEDICINE (Psychiatry Section) (Annual General Meeting), at 8.30.—Dr. D. Forsyth: The Psycho-Analysis of a Case of Early Paranoid Dementia.

WEDNESDAY, JUNE 2.

INSTITUTION OF GAS ENGINEERS (at Institution of Mechanical Engineers), at 10 a.m.—Third Report of the Gas Investigation Committee.

ROYAL HORTICULTURAL SOCIETY (at Royal Gardens, Chelsea), at 3.—Dr. A. B. Rendle: Plants of Interest in the Exhibition.

SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS (at Chemical Society), at 8.—R. Leitch Morris: Perchlorate Method for Potash.—H. Droop Richmond: Estimation for Nitroglycerine.—E. R. Dovey: Apparatus for Evolution Methods of Analysis: An Improved Form of U-tube.

THURSDAY, JUNE 3.

INSTITUTION OF GAS ENGINEERS (at Institution of Mechanical Engineers), at 10 a.m.—Society of British Gas Industries: Carbonisation.—H. J. Hodsman and Prof. J. W. Cobb: Oxygen in Gas Production.—J. Fisher: Electricity Supply by Gas Companies.—G. Warburton: Contemplations on the Report of the Fuel Research Board.

ROYAL HORTICULTURAL SOCIETY (at Royal Gardens, Chelsea), at 3.—Capt. H. J. Page: Green Manuring—Its Possibilities in Horticulture.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—William Archer: Dreams with Special Reference to Psycho-Analysis.

ROYAL SOCIETY, at 4.30.—Sir Ernest Rutherford: The Nuclear Constitution of the Atom (Bakerian Lecture).

LINNEAN SOCIETY OF LONDON, at 5.—R. Swainson-Hall: Exhibition of 50 Drawings of the Oil-Palm, *Elaeis guineensis*.—A. Whitehead: Objects Observed near Basra during the War.—Prof. W. J. Dakin: Whaling in the Southern Ocean.—Dr. R. R. Gates: Demonstration of Chromosomes in the Pollen Development of Lettuce.

CHEMICAL SOCIETY, at 8.

ROYAL SOCIETY OF MEDICINE (Obstetrics and Gynæcology Section), at 8.—Dr. P. Turner: Traumatic Rupture of the Pedicle of a Sub-Peritoneal Fibroid.—Dr. F. Anderson: A Case of Rupture of the Uterus.—Dr. F. Shaw and Dr. Burrows: Radical Cure of Advanced Carcinoma of the Cervix, made Possible by the Application of Radium.—G. Ley: The Pathology of Ante-Partum Hæmorrhage.

FRIDAY, JUNE 4.

ROYAL SOCIETY OF ARTS (Indian and Colonial Sections, Joint Meeting), at 4.30.—Prof. Sir John Cadman: The Oil Resources of the British Empire.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Sir Ronald Ross: Science and Poetry.

SATURDAY, JUNE 5.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. J. H. Jeans: The Theory of Quanta.

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